

APPENDIX D.1: FEASIBILITY CONCEPTS POND AND NEW SWM BMP SITES

Storm Water Management Retrofit Evaluation					
Report Date:	3/22/2019	Design Approval:	7/22/1981	Maintenance Owner:	David & Margaret Crow
Structure No (NPDES Number):	413	As-Built Date:	8/3/1982	Inspection Date:	5/30/2018
Structure Name:	Springdale Detention Pond	NPDES Watershed:	Catoctin Creek	Inspection Team:	MV, JS
Location:	West of Deer Spring Lane	MDE 8 Digit Name/#:	Catoctin Creek (2140305)	Last Significant Rainfall:	5/22/2018 (0.42")
Northing/Easting:	638280.05/1168136.28	Land-River Segment:	B24021PM1_4000_4290	Rainfall Source:	www.wunderground.com
		Stream Use:	1P	Station:	KMDJEFFE3
BMP Description					
	Existing Condition		Proposed Condition		
General BMP Information					
BMP Type:	Dry Pond		Wet Pond (P-2)		
BMP Classification:	N/A		Stormwater Treatment (ST) Practice		
Management Type:	Quantity		Quantity/Quality		
Total Drainage Area (acres):	39.45		59.82		
Total Impervious Area within Drainage Area (acres):	Unknown		7.99		
WQv Required:	Unknown		43429 cu.ft.	1.00 ac.ft.	
Does Facility Meet MDE 2000 WQv Requirements (Y/N):	No		Yes		
Adequate ROW (Y/N):	Yes		Yes		
Adequate Access (Y/N):	No		Yes		
Estimated Treatment Provided		Per Design	Per MDE 2000 Standards		
WQv Provided:		Unknown	0	47596.84 cu.ft.	1.09 ac.ft.
Total Treated Drainage Area (acres):		39.45	0	59.82	
Minimum Impervious Area Treatment Provided (ac):		Unknown	0	7.99	
Estimated Pollutant Removal Rates					
Minimum Runoff Volume Treated per Impervious Acre (in.)			1.00		
Total Nitrogen:			34.95%		
Total Phosphorus:			54.92%		
Sediment:			69.90%		
Estimated Pollutant Load Reduction			Edge of Stream (EOS)		Edge of Tide (EOT)
TN (lbs/yr):		0	123.61		95.79
TP (lbs/yr):		0	25.51		16.73
TSS (lbs/yr):		0	22320.63		12140.01
Projected Retrofit Cost:					\$292,849.48

SITE ID: BMP #413

Prioritization Ranking: 1

Planning/Construction Level Cost Estimate: \$292,849.48

Estimated Cost/Impervious Acre: \$36,652.00

General BMP Information		
Structure Location:	West of Deer Spring Lane	
NPDES Number:	413	
Northing/Easting:	638280.05/1168136.28	
NPDES Watershed:	Catoctin Creek	
MDE 8 Digit Watershed:	Catoctin Creek (2140305)	
Proposed BMP Retrofit General Information		
Proposed BMP Type:	Wet Pond (P-2)	
Management Type:	Quantity/Quality	
Total Drainage Area (ac):	59.82	
Total Impervious Area (ac):	7.99	
Water Quality Treatment Provided:		
WQv Provided (cu.ft.):	47596.84	
Total Treated Drainage Area (ac):	59.82	
Minimum Impervious Area Treatment Provided (ac):	7.99	
Estimated Nutrient Reductions:	EOS	EOT
TN (lbs/yr):	123.61	95.79
TP (lbs/yr):	25.51	16.73
TSS (lbs/yr):	22320.63	12140.01



BMP #413

Required Permitting	
Frederick County SWM Review	X
Erosion and Sediment Control (ESC):	X
Grading Permit:	X
Joint Permit Application (JPA)/General Waterway Construction Permit*:	X
Construction NOI:	X
Other: 1. Depending on the final proposed design, the facility may have to go through MDE Dam Safety. 2.*Depending on final proposed design, the facility may qualify for coverage under the Chesapeake Bay TMDL Regional Permit for impacts to wetland and waterways.	

EXISTING SITE CONDITIONS

BMP #413 is an existing in-stream dry pond (Photo 1) with a 42" ALCMP riser. The ALCMP riser has a 12" low flow orifice and a 24" ALCMP principal spillway that outfalls south of the facility (Photo 2). There is one (1) inflow to this facility. Inflow #1 is a stream which is conveyed via a 12" CPP driveway culvert and a 22" x 28" CMP driveway culvert and enters the facility in the northeast corner. There is severe erosion in the downstream channel (Photo 3), around both of the driveway culverts (Photo 4) and in the inflow channel (Photo 5). There is an exposed telecom utility in the inflow channel (Photo 6). There is a 20' emergency spillway located in the southeast corner of the facility. The facility is overgrown with trees and vegetation and there is a large amount of sediment accumulated within the dry pond. There are no overhead utilities present at the site or along the proposed access road. The surrounding land use is low-density residential and large lot subdivision (forest).

PROPOSED RETROFIT

The proposed facility type for BMP #413 is a wet pond which will provide quality and quantity management for 59.82 acres including a minimum impervious area treatment of 7.99 acres. The proposed retrofit will require grading outside

of the existing facility footprint in order to provide full water quality treatment. The retrofit design includes a forebay to capture flow from Inflow #1 and replacement of the ALCMP riser with a concrete riser. Inflow stabilization is proposed below the 12" CPP cross-culvert and below the 22" x 28" CMP cross culvert (CATO-2018-STRE-0030). The depth, size, and slope of the cross-culverts should be analyzed prior to final design to ensure positive drainage is achieved. Outfall stabilization is proposed downstream of the existing 24" CMP outfall (CATO-2018-STRE-0031). The site can be accessed via two access roads from the driveway off of Deer Spring Lane.

The County could evaluate an alternative retrofit approach which would include replacing the in-stream pond with a regenerative step pool conveyance in combination with pocket wetlands. The downstream impacts of this alternative approach would be required during final design to make sure the pocket wetlands provide adequate quantity storage and there is no increase in flooding downstream.

ANTICIPATED SITE CONSTRAINTS

There is an exposed telecom utility in the inflow channel – utility relocations are likely. Significant tree impacts are probable.



Photo 1: Overall facility looking west



Photo 2: 24" ALCMP outfall looking north



Photo 3: Erosion in downstream channel looking southwest



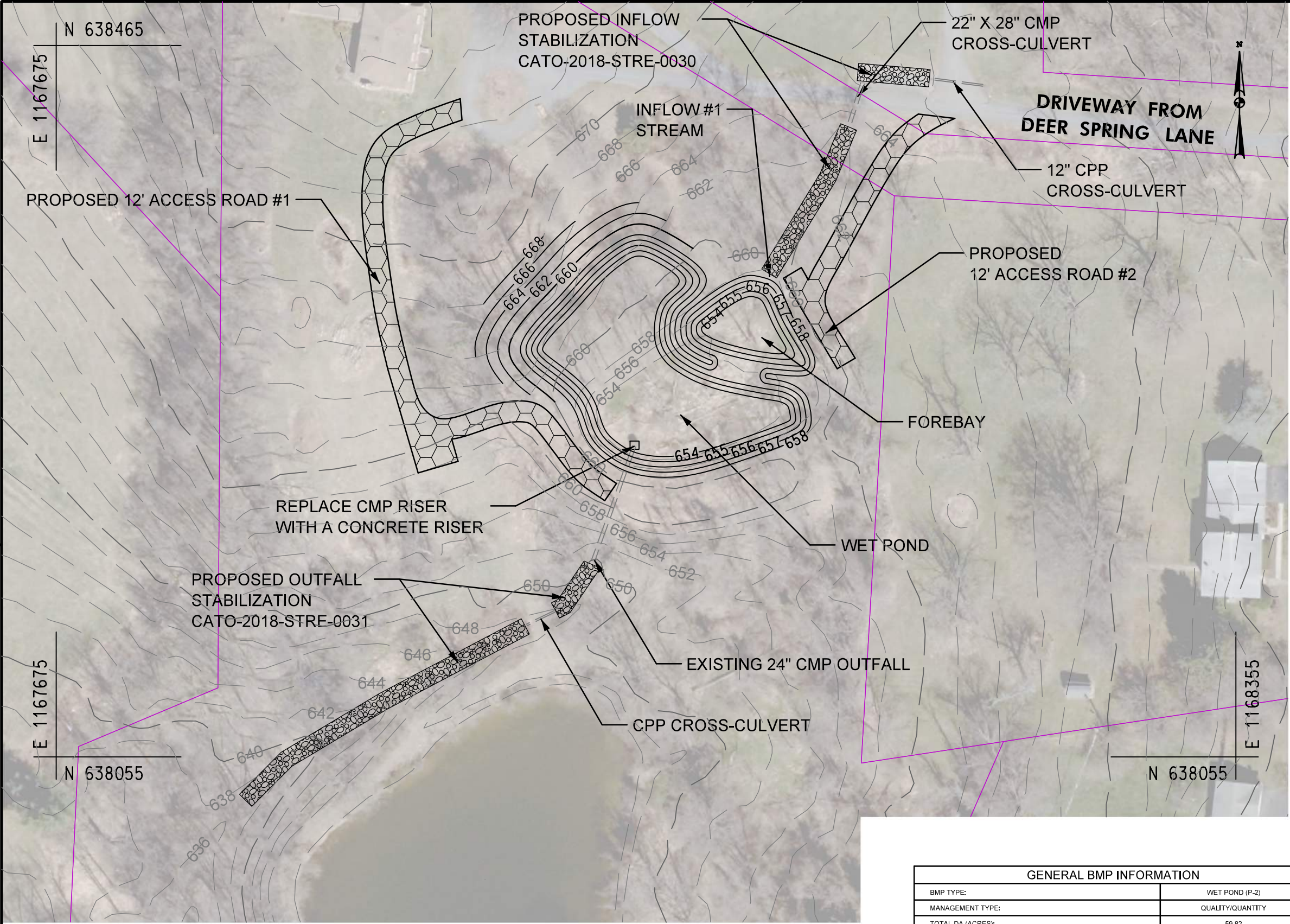
Photo 4: Erosion around driveway culverts looking east



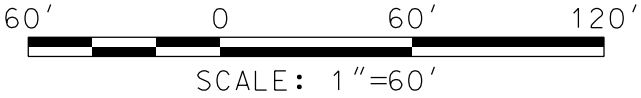
Photo 5: Erosion in inflow channel looking south




Photo 6: Exposed telecom utility



NOTE:
1. CROSS-CULVERTS SHOULD BE ANALYZED PRIOR TO FINAL DESIGN.
2. AN ALTERNATE APPROACH OF REPLACING THE IN-LINE POND WITH AN RSC/STEP POOLS IN COMBINATION WITH POCKET WETLANDS SHOULD BE EVALUATED DURING FINAL DESIGN. EVALUATION OF THE DOWNSTREAM IMPACTS WOULD BE REQUIRED.



GENERAL BMP INFORMATION	
BMP TYPE:	WET POND (P-2)
MANAGEMENT TYPE:	QUALITY/QUANTITY
TOTAL DA (ACRES):	59.82
TOTAL IMPERVIOUS AREA (ACRES):	7.99
WQv REQUIRED (CU. FT):	43429.32
WQv REQUIRED (AC. FT):	1.00
WATER QUALITY TREATMENT PROVIDED	
WQv PROVIDED (CU. FT):	47596.84
TOTAL TREATED DA (ACRES):	59.82
MINIMUM IMPERVIOUS AREA TREATMENT PROVIDED (ACRES):	7.99




Catocin Creek Watershed Assessment
Frederick County Office of Sustainability
and Environmental Resources
Frederick, MD 21701

BMP #413

SCALE 1"=60' ADVERTISED DATE CONTRACT NO.

DESIGNED BY VH COUNTY Frederick, MD
DRAWN BY VH LOGMILE
CHECKED BY MJ HORIZONTAL SCALE
VERTICAL SCALE

DRAWING NO. OF SHEET NO. OF



Dewberry[®]
Dewberry Engineers
10461 MILL RUN CIRCLE
SUITE #300
OWINGS MILLS, MARYLAND 21117
PHONE: 410.265.9500
FAX: 410.265.8875

LEGEND

400

EXISTING GIS CONTOURS

400

PROPOSED CONTOURS

BY: vhamsher -

WET POND DESIGN (P-2): BMP 413

This spreadsheet is for **design level calculations** of Wet Pond

Sources for Regulations:

2000 MDE Stormwater Manual Volume I and II

MDE's Accounting Guidance, Accounting of Stormwater Wasteload Allocations, and Impervious Acres Treated (2014)

SWM BMP Retrofit Assessment

Requirement List

Step	Category	Required?	Notes
1	Water Quality Volume (WQv)	Yes	Pe=1.0 min
2	Recharge Volume (Rev)	Yes	Included in WQv
3	Quantity Management	Yes	Maintain Existing Quantity Management

Note: Blue cells in this sheet and "Flows", "Stage-Storage", and "BMP" sheets are user entries

Design Parameters:

Project: **Catoctin Creek Watershed Assessment**

Location: **Frederick County, MD**

Watershed: **Catoctin Creek**

Engineer: **VLH**

Date: **2/1/2019**

As Built:

Drainage Area: **59.82** Acres 0.093 square miles

(Total)

Measured Impervious Area: **7.99** Acres I = 0.134
= 13.4 %

Soil Type: **B, C**

RCN Existing : **64** Existing tc = **0.40** hr

RCN Post Development : **64** Post-D tc = **0.40** hr

Select Stream Use Classification from drop down menu

Stream Use:

Per Frederick County's NPDES SWMF

Step 1: WQv Value

$$WQ_v = \frac{(P)(R_v)(A)}{12}$$

Step 1(a): Compute volumetric Runoff Coefficient(Rv)

$$R_v = 0.05 + (0.009)I = 0.170$$

Step 1(b): Rainfall Zone

Rainfall Zone: P = 1.0 inch

(0.9" for Eastern Rainfall Zone, 1.0" for Western Rainfall zone)

1" per MDE's Accounting Guidance, Accounting of Stormwater Wasteload Allocations, and Impervious Acres Treated (2014)

Step 1(c): Compute WQv

Water quality required for I = 13.4 %

$$WQ_{V(I)} = 0.849 \text{ ac-ft} = 36960 \text{ cu.ft}$$

Minimum water quality required 0.2 inches per acre of the drainage area,

$$WQ_{V(\text{Min})} = 0.997 \text{ ac-ft} = 43429.32 \text{ cu.ft}$$

Water quality treatment required =

$$43429 \text{ cu.ft} =$$

$$0.9970 \text{ ac-ft}$$

1

WQv provided by other practices =

$$0 \text{ cu.ft} =$$

$$0.0000 \text{ ac-ft}$$

Net water quality treatment required =

$$43429 \text{ cu.ft} =$$

$$0.9970 \text{ ac-ft}$$

Sediment Forebay Volume Required=

$$4343 \text{ cu.ft} =$$

$$0.0997 \text{ ac-ft}$$

Forebay Volume = 0.1" runoff

WQv in pond =

$$39086 \text{ cu.ft} =$$

$$0.8973 \text{ ac-ft}$$

Elevation at the Top of WQv in pond =

$$657.94 \text{ ft}$$

Forebay storage counts toward total WQv requirement.

The Stream Use Classification was used to set WQv distribution in forebay, micropool and active storage

For this case: Use Classification= I 50% of WQv is in micropool

Use Classification	Portion of WQv*	WQv in micropool
I	50% of WQv is in micropool	21715
II	50% of WQv is in micropool	21715
III	1/3 of WQv is in micropool & forebay	10134
IV	1/3 of WQv is in micropool & forebay	10134

*source: SHA SWM Workshop, April 30, 2003

Step 1(d): Water quality release rate

Minimum WQv release time should be

24

-hr drawdown for the portion of WQv in pond above orifice

Hence, WQrr = 0.25 cfs

WQrr = Micropool Storage Volume required/24hrs/3600sec/hr

With WQv, determine the required orifice area (Ao) for extended detention design:

$$A_o = \frac{WQrr}{4.81 \sqrt{h_o}}$$

Assume $h_o = 1.49$ ft

*Will change based on pond volume

$$A_o = 0.04 \text{ sf}$$

Determine the required orifice diameter (d_o)

$$D_o = \sqrt{\frac{4 A_o}{\pi}}$$

$$D_o = 0.23 \text{ ft} = 2.8 \text{ inches.}$$

Step 2: Compute Recharge Volume (Rev)

$$Rev = \frac{(S)(Rv)(A)}{12}$$

Step 2(a): Determine Soil Specific Recharge Factor (S) Based on Hydrologic Soil Group

1334950.504

HSG	Soil Specific Recharge Factor (s)
A	0.38
B	0.26
C	0.13
D	0.07

HSG	Drainage Area (Acres)	Percentage (%)
A	0.00	0
B	31.30	52
C	28.50	48
D	0.00	0
Total	59.80	OK: sum of the areas matches site Area

Composite S: 0.1980 Use 19.80 of site imperviousness

Step 2(b): Compute Rev Using Percent Volume Method

Rev = $[(S)(Rv)(A)]/12 =$ 0.168 ac-ft = 7320 cu.ft
 Rev in Pond= 2977
 El of Rev= 654.38 ft from El-storage

Step 2(c): Compute Rev Using Percent Area Method

Rev = (S)(Ai) = 1.582 Acres = 68927 sf

The Rev requirement may be met by:

- a) treating 0.168 ac-ft using structural method,
- b) treating 1.582 acres using non-structural methods, or
- c) a combination of both or it is part of WQv volume if not treated separately.

Project: Catoctin Creek Watershed Assessment Engineer: VLH
 Location: Frederick County, MD Date: 2/1/2019
 Watershed: Catoctin Creek

STAGE-STORAGE CALCULATIONS

POND

$$V = h/3 * [A1 + A2 + \text{SQRT}(A1*A2)]$$

Area (sq.ft)	Elevation (ft)	Area (acres)	Incr. Depth (ft)	Inc. Volume (acre-ft)	TOTAL VOLUME (acre-ft) (cu.ft)	
7273.2	654.0	0.17	0.00	0.00	0.00	0.00
8565.9	655.0	0.20	1.00	0.18	0.18	7910.73
9920.7	656.0	0.23	1.00	0.21	0.39	17145.72
11337.8	657.0	0.26	1.00	0.24	0.64	27767.09
12817.1	658.0	0.29	1.00	0.28	0.91	39836.98

No. of valid row entries= 5

Project: Catoctin Creek Watershed Assessment Engineer: VLH
 Location: Frederick County, MD Date: 2/1/2019
 Watershed: Catoctin Creek

STAGE-STORAGE CALCULATIONS

FOREBAY

$$V = h/3 * [A1 + A2 + \text{SQRT}(A1*A2)]$$

Area (sq.ft)	Elevation (ft)	Area (acres)	Incr. Depth (ft)	Inc. Volume (acre-ft)	TOTAL VOLUME (acre-ft) (cu.ft)	
970.6	654.0	0.02	0.00	0.00	0.00	0.00
1395.9	655.0	0.03	1.00	0.03	0.03	1176.84
1907.7	656.0	0.04	1.00	0.04	0.06	2821.96
2460.3	657.0	0.06	1.00	0.05	0.11	5000.08
3070.5	658.0	0.07	1.00	0.06	0.18	7759.86

No. of valid row entries= 5

Storm Water Management Retrofit Evaluation					
Report Date:	3/22/2019	Design Approval:	8/17/1995	Maintenance Owner:	Holy Family Catholic Church
Structure No (NPDES Number):	419	As-Built Date:*	8/30/2011	Inspection Date:	5/1/2018
Structure Name:	Holy Family Catholic Community Worship Center	NPDES Watershed:	Catoctin Creek	Inspection Team:	MV, JS
Location:	Southeast of the Holy Family Catholic Church parking lot off of MD 17	MDE 8 Digit Name/#:	Catoctin Creek (2140305)	Last Significant Rainfall:	4/27/2018 (0.39")
Northing/Easting:	643620.32/1157846.43	Land-River Segment:	B24021PM1_4000_4290	Rainfall Source:	www.wunderground.com
		Stream Use:	1P	Station:	KMDJEFFE3
BMP Description					
	Existing Condition			Proposed Condition	
General BMP Information					
BMP Type:	Extended Detention Wet Pond			Wet Extended Detention Pond (P-3)	
BMP Classification:	N/A			Stormwater Treatment (ST) Practice	
Management Type:	Quantity/Quality			Quantity/Quality	
Total Drainage Area (acres):	9.17			9.65	
Total Impervious Area within Drainage Area (acres):	Unknown			3.35	
WQv Required:	Unknown			12684 cu.ft.	0.29 ac.ft.
Does Facility Meet MDE 2000 WQv Requirements (Y/N):	No			Yes	
Adequate ROW (Y/N):	Yes			Yes	
Adequate Access (Y/N):	No			Yes	
Estimated Treatment Provided		Per Design	Per MDE 2000 Standards		
WQv Provided:		Unknown	0	14276.48 cu.ft.	0.33 ac.ft.
Total Treated Drainage Area (acres):		9.17	0	9.65	
Minimum Impervious Area Treatment Provided (ac):		Unknown	0	3.35	
Estimated Pollutant Removal Rates					
Minimum Runoff Volume Treated per Impervious Acre (in.)	N/A			1.00	
Total Nitrogen:				34.95%	
Total Phosphorus:				54.92%	
Sediment:				69.90%	
Estimated Pollutant Load Reduction			Edge of Stream (EOS)		Edge of Tide (EOT)
TN (lbs/yr):		0	28.77		21.62
TP (lbs/yr):		0	5.28		3.48
TSS (lbs/yr):		0	5236.99		2848.92
Projected Retrofit Cost:					\$122,784.20

*As-Built Date from the NPDES Database does not match the as-built date shown on the as-built plans.

SITE ID: BMP #419

Prioritization Ranking: 2

Planning/Construction Level Cost Estimate: \$122,784.20

Estimated Cost/Impervious Acre: \$36,652.00

<u>General BMP Information</u>		
Structure Location:	Southeast of the Holy Family Catholic Church parking lot off of MD 17	
NPDES Number:	419	
Northing/Easting:	643620.32/1157846.43	
NPDES Watershed:	Catoctin Creek	
MDE 8 Digit Watershed:	Catoctin Creek (2140305)	
<u>Proposed BMP Retrofit General Information</u>		
Proposed BMP Type:	Wet Extended Detention Pond (P-3)	
Management Type:	Quantity/Quality	
Total Drainage Area (ac):	9.65	
Total Impervious Area (ac):	3.35	
<u>Water Quality Treatment Provided:</u>		
WQv Provided (cu.ft.):	14276.48	
Total Treated Drainage Area (ac):	9.65	
Minimum Impervious Area Treatment Provided (ac):	3.35	
<u>Estimated Nutrient Reductions:</u>	<u>EOS</u>	<u>EOT</u>
TN (lbs/yr):	28.77	21.62
TP (lbs/yr):	5.28	3.48
TSS (lbs/yr):	5236.99	2848.92



BMP #419

Required Permitting	
Frederick County SWM Review	X
Erosion and Sediment Control (ESC):	X
Grading Permit:	X
Joint Permit Application (JPA)/General Waterway Construction Permit:	
Construction NOI:	
Other: MDE Dam Safety	

EXISTING SITE CONDITIONS

BMP #419 is an existing extended detention wet pond with two forebays and a recharge area (Photo 1) located behind the Holy Family Catholic Church parking lot. The original facility was designed in 1995, but was retrofitted in 2006 to provide treatment for building and parking lot expansions. The control structure is a 24" CMP riser (Photo 2) with a 15" CMP principal spillway that outfalls to the southeast of the facility (Photo 3). There are two (2) inflows to this facility. Inflow #1 is a grass ditch that drains to a riprap ditch prior to entering Forebay #1. Inflow #2 is a grass ditch that drains to a riprap ditch prior to entering Forebay #2. There is severe erosion within the riprap portion of Inflow #1 (Photo 4). Forebay #1 and Forebay #2 both drain into the recharge area before entering the facility. The facility has an emergency spillway located in the southern corner. There are existing drainage issues located where the parking lot drains to Inflow #2 on the northwest side of the Holy Family Catholic Church building. There are no overhead utilities present at the site or along the proposed access road. The surrounding land use is institutional and cropland.

PROPOSED RETROFIT

The proposed facility type for BMP #419 is a wet extended detention pond (P-3) which will provide quality and quantity management for 9.65 acres including a minimum impervious area treatment of 3.35 acres. Per our analysis of available design plans and GIS contours, the existing facility provides full water quality treatment; therefore, no additional grading is proposed. We are proposing repair of Inflow #1 due to correct the severe erosion issues present, replacement of the existing CMP riser with a concrete riser, and replacement of the existing 15" CMP outfall. Replacement of the existing CMP riser with a concrete riser will include a low flow orifice that provides greater than 1" of treatment. Thermal impacts should be evaluated during final design. The site can be accessed via MD 17 (Burkittsville Road).

ANTICIPATED SITE CONSTRAINTS

There is a septic area that is adjacent to Forebay #1.



Photo 1: Overall facility looking southeast



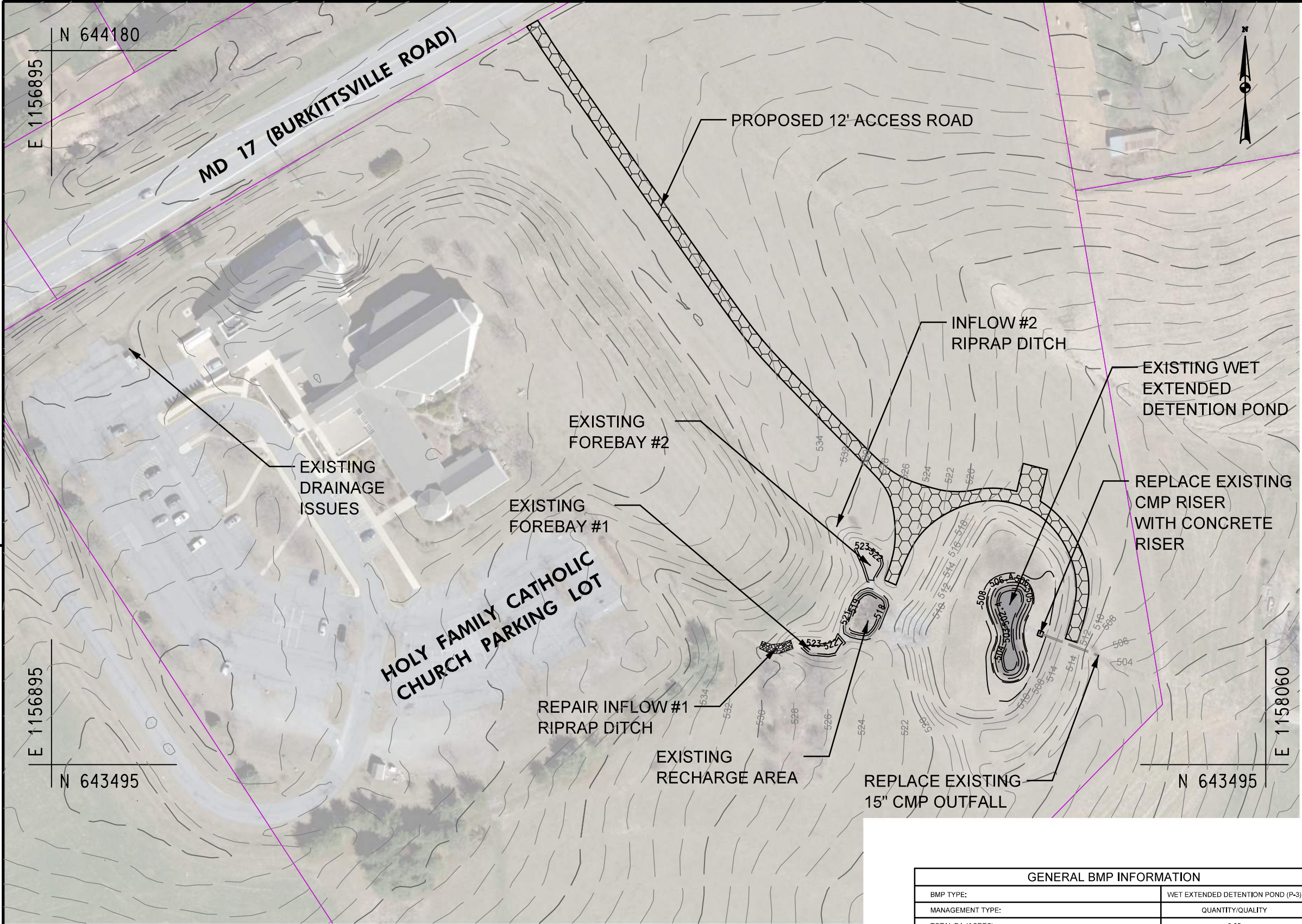
Photo 2: 24" CMP riser looking southeast



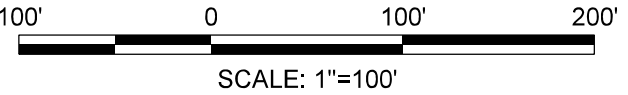
Photo 3: 15" CMP outfall looking northwest




Photo 4: Severe erosion in Inflow #1 riprap ditch looking south



NOTE:
1. CONTOURS INSIDE THE FOREBAYS, RECHARGE AREA AND FACILITY WERE NOT AVAILABLE VIA GIS. THEREFORE, CONTOURS WERE DIGITIZED FROM THE DESIGN PLANS "AP3607_NEWPLANS".
2. EXISTING QUALITY MANAGEMENT PROVIDED WAS VERIFIED USING THE DIGITIZED CONTOURS.
3. REPLACEMENT OF THE EXISTING CMP RISER WITH A CONCRETE RISER WILL INCLUDE A LOW FLOW ORIFICE THAT PROVIDES GREATER THAN 1" OF TREATMENT.
4. THERMAL IMPACTS SHOULD BE EVALUATED DURING FINAL DESIGN.



GENERAL BMP INFORMATION	
BMP TYPE:	WET EXTENDED DETENTION POND (P-3)
MANAGEMENT TYPE:	QUANTITY/QUALITY
TOTAL DA (ACRES):	9.65
TOTAL IMPERVIOUS AREA (ACRES):	3.35
WQv REQUIRED (CU. FT):	12684.93
WQv REQUIRED (AC. FT):	0.29
WATER QUALITY TREATMENT PROVIDED	
WQv PROVIDED (CU. FT):	14276.48
TOTAL TREATED DA (ACRES):	9.65
MINIMUM IMPERVIOUS AREA TREATMENT PROVIDED (ACRES):	3.35




Catoclin Creek Watershed Assessment
Frederick County Office of Sustainability
and Environmental Resources
Frederick, MD 21701

BMP #419

SCALE 1" = 100' ADVERTISED DATE CONTRACT NO.

DESIGNED BY VH COUNTY Frederick, MD
DRAWN BY VH LOGMILE
CHECKED BY MJ HORIZONTAL SCALE
VERTICAL SCALE

DRAWING NO. OF SHEET NO. OF



Dewberry[®]
Dewberry Engineers
10461 MILL RUN CIRCLE
SUITE #300
OWINGS MILLS, MARYLAND 21117
PHONE: 410.265.9500
FAX: 410.265.8875

LEGEND

— 400 —

PARCEL BOUNDARY

— 400 —

EXISTING GIS CONTOURS

— 400 —

EXISTING DESIGN PLAN CONTOURS

BY: vhamsher -

WET EXTENDED DETENTION POND DESIGN (P-2): BMP 419

This spreadsheet is for **design level calculations** of Wet Extended Detention Pond

The below calculations demonstrate that the existing wet extended detention pond currently provides 1" of treatment in existing conditions.

Sources for Regulations:

2000 MDE Stormwater Manual Volume I and II

MDE's Accounting Guidance, Accounting of Stormwater Wasteload Allocations, and Impervious Acres Treated (2014)

SWM BMP Retrofit Assessment

Requirement List

Step	Category	Required?	Notes
1	Water Quality Volume (WQv)	Yes	Pe=1.0 min
2	Recharge Volume (Rev)	Yes	Included in WQv
3	Quantity Management	Yes	Maintain Existing Quantity Management

Note: Blue cells in this sheet and "Flows", "Stage-Storage", and "BMP" sheets are user entries

Design Parameters:

Project: **Catoctin Creek Watershed Assessment**

Engineer: **VLH**

Location: **Frederick County, MD**

Date: **1/31/2019**

Watershed: **Catoctin Creek**

As Built:

Drainage Area: **9.65** Acres 0.015 square miles

Select Stream Use Classification from drop down menu

Measured Impervious Area:

3.35

Acres

I = 0.347

= 34.7

Stream Use:

%

Soil Type: **B**

RCN Existing :

77

Existing tc =

0.10

hr

RCN Post Development :

77

Post-D tc =

0.10

hr

Per Frederick County's NPDES SWMF

Step 1: WQv Value

$$WQ_v = \frac{(P)(R_v)(A)}{12}$$

Step 1(a): Compute volumetric Runoff Coefficient(Rv)

$$R_v = 0.05 + (0.009)I = 0.362$$

Step 1(b): Rainfall Zone

Rainfall Zone: P = 1.0 inch (0.9" for Eastern Rainfall Zone, 1.0" for Western Rainfall zone)
1" per MDE's Accounting Guidance, Accounting of Stormwater Wasteload Allocations, and Impervious Acres Treated (2014)

Step 1(c): Compute WQv

Water quality required for I = 34.7 %

$$WQ_{V(I)} = 0.291 \text{ ac-ft} = 12683.93 \text{ cu.ft}$$

Minimum water quality required 0.2 inches per acre of the drainage area,

$$WQ_{V(\text{Min})} = 0.161 \text{ ac-ft} = 7002.399228 \text{ cu.ft}$$

Water quality treatment required =

$$12684 \text{ cu.ft} =$$

$$0.2912 \text{ ac-ft}$$

1

WQv provided by other practices =

$$0 \text{ cu.ft} =$$

$$0.0000 \text{ ac-ft}$$

Net water quality treatment required =

$$12684 \text{ cu.ft} =$$

$$0.2912 \text{ ac-ft}$$

Sediment Forebay Volume Required=

$$1268 \text{ cu.ft} =$$

$$0.0291 \text{ ac-ft}$$

Forebay Volume = 0.1" runoff

WQv in pond =

$$11416 \text{ cu.ft} =$$

$$0.2621 \text{ ac-ft}$$

Elevation at the Top of WQv in pond =

$$506.40 \text{ ft}$$

Forebay storage counts toward total WQv requirement.

The Stream Use Classification was used to set WQv distribution in forebay, micropool and active storage

For this case: Use Classification= I 50% of WQv is in micropool

Use Classification	Portion of WQv*	WQv in micropool
I	50% of WQv is in micropool	6342
II	50% of WQv is in micropool	6342
III	1/3 of WQv is in micropool & forebay	2960
IV	1/3 of WQv is in micropool & forebay	2960

*source: SHA SWM Workshop, April 30, 2003

Micropool storage volume required =

$$6342 \text{ cu.ft} =$$

$$0.1456 \text{ ac-ft}$$

Extended Detention Storage=

$$6342$$

cu.ft

= Dead Storage Volume

cu.ft

Extended Detention Elevation=

$$505.88$$

ft

= Dead Storage El =

orifice El. From El-Storage

Step 1(d): Water quality release rate

Minimum WQv release time should be 24

-hr drawdown for the portion of WQv in pond above orifice

Hence, WQrr = 0.07 cfs

WQrr = Micropool Storage Volume required/24hrs/3600sec/hr

With WQv, determine the required orifice area (Ao) for extended detention design:

$$A_o = \frac{WQrr}{4.81 \sqrt{h_o}}$$

Assume h_o = 0.52 ft

*Will change based on pond volume

Ao = 0.02 sf

Determine the required orifice diameter (d_o)

$$D_o = \sqrt{\frac{4 A_o}{\pi}}$$

Do = 0.16 ft = 2.0 inches.

Step 2: Compute Recharge Volume (Rev)

$$Rev = \frac{(S)(Rv)(A)}{12}$$

Step 2(a): Determine Soil Specific Recharge Factor (S) Based on Hydrologic Soil Group

1334950.504

HSG	Soil Specific Recharge Factor (s)
A	0.38
B	0.26
C	0.13
D	0.07

HSG	Drainage Area (Acres)	Percentage (%)
A	0.00	0
B	9.60	100
C	0.00	0
D	0.00	0
Total	9.60	OK: sum of the areas matches site Area

Composite S: 0.2600 Use 26.00 of site imperviousness

Step 2(b): Compute Rev Using Percent Volume Method

Rev = $[(S)(Rv)(A)]/12 =$ 0.076 ac-ft = 3298 cu.ft
 Rev in Pond= 2029
 EI of Rev= 504.02 ft from EI-storage

Step 2(c): Compute Rev Using Percent Area Method

Rev = (S)(Ai) = 0.870 Acres = 37902 sf

The Rev requirement may be met by:

- a) treating 0.076 ac-ft using structural method,
- b) treating 0.870 acres using non-structural methods, or
- c) a combination of both or it is part of WQv volume if not treated separately.

Project: Catoctin Creek Watershed Assessment Engineer: VLH
 Location: Frederick County, MD Date: 1/31/2019
 Watershed: Catoctin Creek

STAGE-STORAGE CALCULATIONS

POND

$$V = h/3 * [A1 + A2 + \text{SQRT}(A1*A2)]$$

Area (sq.ft)	Elevation (ft)	Area (acres)	Incr. Depth (ft)	Inc. Volume (acre-ft)	TOTAL VOLUME (acre-ft) (cu.ft)	
795.3	502.4	0.02	0.00	0.00	0.00	0.00
1128.2	503.0	0.03	0.60	0.01	0.01	574.15
1728.4	504.0	0.04	1.00	0.03	0.05	1991.85
2385.1	505.0	0.05	1.00	0.05	0.09	4039.82
3098.4	506.0	0.07	1.00	0.06	0.16	6773.81
3399.5	506.4	0.08	1.00	0.07	0.23	10021.62
		0.00	0.00	0.00	0.00	0.00
		0.00	0.00	0.00	0.00	0.00
		0.00	1.00	0.00	0.00	0.00

No. of valid row entries= 6

Project: Catoctin Creek Watershed Assessment Engineer: VLH
 Location: Frederick County, MD Date: 1/31/2019
 Watershed: Catoctin Creek

STAGE-STORAGE CALCULATIONS

FOREBAY #1

$$V = h/3 * [A1 + A2 + \text{SQRT}(A1*A2)]$$

Area (sq.ft)	Elevation (ft)	Area (acres)	Incr. Depth (ft)	Inc. Volume (acre-ft)	TOTAL VOLUME (acre-ft) (cu.ft)	
273.8	522.0	0.01	0.00	0.00	0.00	0.00
469.1	523.0	0.01	1.00	0.01	0.01	367.09
		0.00	0.00	0.00	0.00	0.00
		0.00	0.00	0.00	0.00	0.00
		0.00	0.00	0.00	0.00	0.00

No. of valid row entries= 2

Project: Catoctin Creek Watershed Assessment Engineer: VLH
 Location: Frederick County, MD Date: 1/31/2019
 Watershed: Catoctin Creek

STAGE-STORAGE CALCULATIONS

FOREBAY #2

$$V = h/3 * [A1 + A2 + \text{SQRT}(A1*A2)]$$

Area (sq.ft)	Elevation (ft)	Area (acres)	Incr. Depth (ft)	Inc. Volume (acre-ft)	TOTAL VOLUME (acre-ft) (cu.ft)	
399.7	522.0	0.01	0.00	0.00	0.00	0.00
587.1	523.0	0.01	1.00	0.01	0.01	490.42
		0.00	0.00	0.00	0.00	0.00
		0.00	0.00	0.00	0.00	0.00
		0.00	0.00	0.00	0.00	0.00

No. of valid row entries= 2

Project: Catoctin Creek Watershed Assessment Engineer: VLH
 Location: Frederick County, MD Date: 1/31/2019
 Watershed: Catoctin Creek

STAGE-STORAGE CALCULATIONS

RECHARGE AREA

$$V = h/3 * [A1 + A2 + \text{SQRT}(A1*A2)]$$

Area (sq.ft)	Elevation (ft)	Area (acres)	Incr. Depth (ft)	Inc. Volume (acre-ft)	TOTAL VOLUME (acre-ft) (cu.ft)	
769.3	518.0	0.02	0.00	0.00	0.00	0.00
1000.8	519.0	0.02	1.00	0.02	0.02	882.55
1255.2	520.0	0.03	1.00	0.03	0.05	2008.16
1527.6	521.0	0.04	1.00	0.03	0.08	3397.35
		0.00	0.00	0.00	0.00	0.00

No. of valid row entries= 4

Storm Water Management Retrofit Evaluation					
Report Date:	3/22/2019	Design Approval:	4/25/2001	Maintenance Owner:	The Vistas at Springdale HOA
Structure No (NPDES Number):	1163	As-Built Date:	N/A	Inspection Date:	6/5/2018
Structure Name:	N/A	NPDES Watershed:	Catoctin Creek	Inspection Team:	MV, VH
		MDE 8 Digit Name/#:	Catoctin Creek (2140305)	Last Significant Rainfall:	6/3/2018 (0.18")
Location:	Between Southridge Way and Saratoga Springs Court	Land-River Segment:	B24021PM1_4000_4290	Rainfall Source:	www.wunderground.com
Northing/Easting:	639277.96/1167026.74	Stream Use:	1P	Station:	KMDJEFFE3
BMP Description					
	Existing Condition		Proposed Condition		
General BMP Information					
BMP Type:	Wet Extended Detention Pond		Wet Extended Detention Pond (P-3)		
BMP Classification:	N/A		Stormwater Treatment (ST) Practice		
Management Type:	Unknown		Quantity/Quality		
Total Drainage Area (acres):	Unknown		80.1		
Total Impervious Area within Drainage Area (acres):	Unknown		9.1		
WQv Required:	Unknown		58153 cu.ft.	1.34 ac.ft.	
Does Facility Meet MDE 2000 WQv Requirements (Y/N):	No		Yes		
Adequate ROW (Y/N):	Yes		Yes		
Adequate Access (Y/N):	No		Yes		
Estimated Treatment Provided		Per Design	Per MDE 2000 Standards		
WQv Provided:	Unknown	0	86404.67 cu.ft.	1.98 ac.ft.	
Total Treated Drainage Area (acres):	Unknown	0	80.1		
Minimum Impervious Area Treatment Provided (ac):	Unknown	0	9.1		
Estimated Pollutant Removal Rates					
Minimum Runoff Volume Treated per Impervious Acre (in.)	N/A		1.00		
34.95%					
54.92%					
69.90%					
Total Nitrogen:					
Total Phosphorus:					
Sediment:					
Estimated Pollutant Load Reduction			Edge of Stream (EOS)	Edge of Tide (EOT)	
TN (lbs/yr):	0		200.00	153.48	
TP (lbs/yr):	0		44.02	28.87	
TSS (lbs/yr):	0		32470.52	17659.93	
Projected Retrofit Cost:					\$333,533.20

SITE ID: BMP #1163

Prioritization Ranking: 3

Planning/Construction Level Cost Estimate: \$333,533.20

Estimated Cost/Impervious Acre: \$36,652.00

<u>General BMP Information</u>		
Structure Location:	Between Southridge Way and Saratoga Springs Court	
NPDES Number:	1163	
Northing/Easting:	639277.96/1167026.74	
NPDES Watershed:	Catoclin Creek	
MDE 8 Digit Watershed:	Catoclin Creek (2140305)	
<u>Proposed BMP Retrofit General Information</u>		
Proposed BMP Type:	Wet Extended Detention Pond (P-3)	
Management Type:	Quantity/Quality	
Total Drainage Area (ac):	80.10	
Total Impervious Area (ac):	9.10	
<u>Water Quality Treatment Provided:</u>		
WQv Provided (cu.ft.):	86404.67	
Total Treated Drainage Area (ac):	80.10	
Minimum Impervious Area Treatment Provided (ac):	9.10	
<u>Estimated Nutrient Reductions:</u>	<u>EOS</u>	<u>EOT</u>
TN (lbs/yr):	200.00	153.48
TP (lbs/yr):	44.02	28.87
TSS (lbs/yr):	32470.52	17659.93



BMP #1163

Required Permitting

Frederick County SWM Review	X
Erosion and Sediment Control (ESC):	X
Grading Permit:	X
Joint Permit Application (JPA)/General Waterway Construction Permit:	
Construction NOI:	
Other:	

EXISTING SITE CONDITIONS

BMP #1163 is an existing wet extended detention pond (Photos 1 and 2) with a 23' concrete weir (Photo 3). The concrete weir has a 6" PVC low flow orifice. The facility outfalls to the south into a plunge pool (Photo 4) and then into a ditch (Photo 5). There is erosion present along the downstream side of the embankment (Photo 4) and within the downstream outfall channel (Photo 5). There are overgrown trees and vegetation in the outfall channel. The facility has six (6) inflows. Inflow #1 is a riprap ditch that enters the facility in the northern corner and captures flow from triple 24" ALCMP cross-culverts which convey flow under Southridge Way. Inflow #2 is a riprap ditch that enters the facility in the southwest corner and captures flow from an 18" ALCMP cross-culvert which conveys flow under Southridge Way. Inflow #3 is a riprap ditch that enters the facility in the southeast corner. Inflow #4 is a riprap ditch that enters the facility along the eastern side and captures flow from twin 30" ALCMP cross-culverts which convey flow under Saratoga Springs Court. There is severe erosion and displaced riprap within Inflow #4 (Photo 6). There are no overhead utilities present at the site or along the proposed access road. The surrounding land use is medium-density residential.

PROPOSED RETROFIT

The proposed facility type for BMP #1163 is a wet extended detention pond (P-3) which will provide quality and quantity management for 80.10 acres including a minimum impervious area treatment of 9.10 acres. The proposed facility will be constructed within the existing facility footprint. Three forebays are proposed as part of the retrofit. Forebay #1 will provide pre-treatment for Inflows #1 and #4; forebay #2 will provide pre-treatment for Inflow #3; and forebay #3 will provide pre-treatment for Inflow #2. Flow from Inflow #1, Inflow #3 and Inflow #4 will need to be conveyed underneath the proposed access road via cross-culverts which are adequately sized to carry flows. The severe erosion in Inflow #4 should be repaired during the retrofit. It should be noted that based on available easement data, the erosion issues at Inflow #4 extend onto private property, beyond the existing SWM easement. Also, there are no existing drainage easements for any of the inflows. Acquisition of drainage easements for all four inflows should be evaluated during final design. Thermal impacts should be considered during final design. The site can be accessed via Southridge Way.

ANTICIPATED SITE CONSTRAINTS

Additional SWM easement acquisition may be necessary at this site.



Photo 1: Overall facility looking south



Photo 2: Overall facility looking northeast



Photo 3: Concrete weir looking south



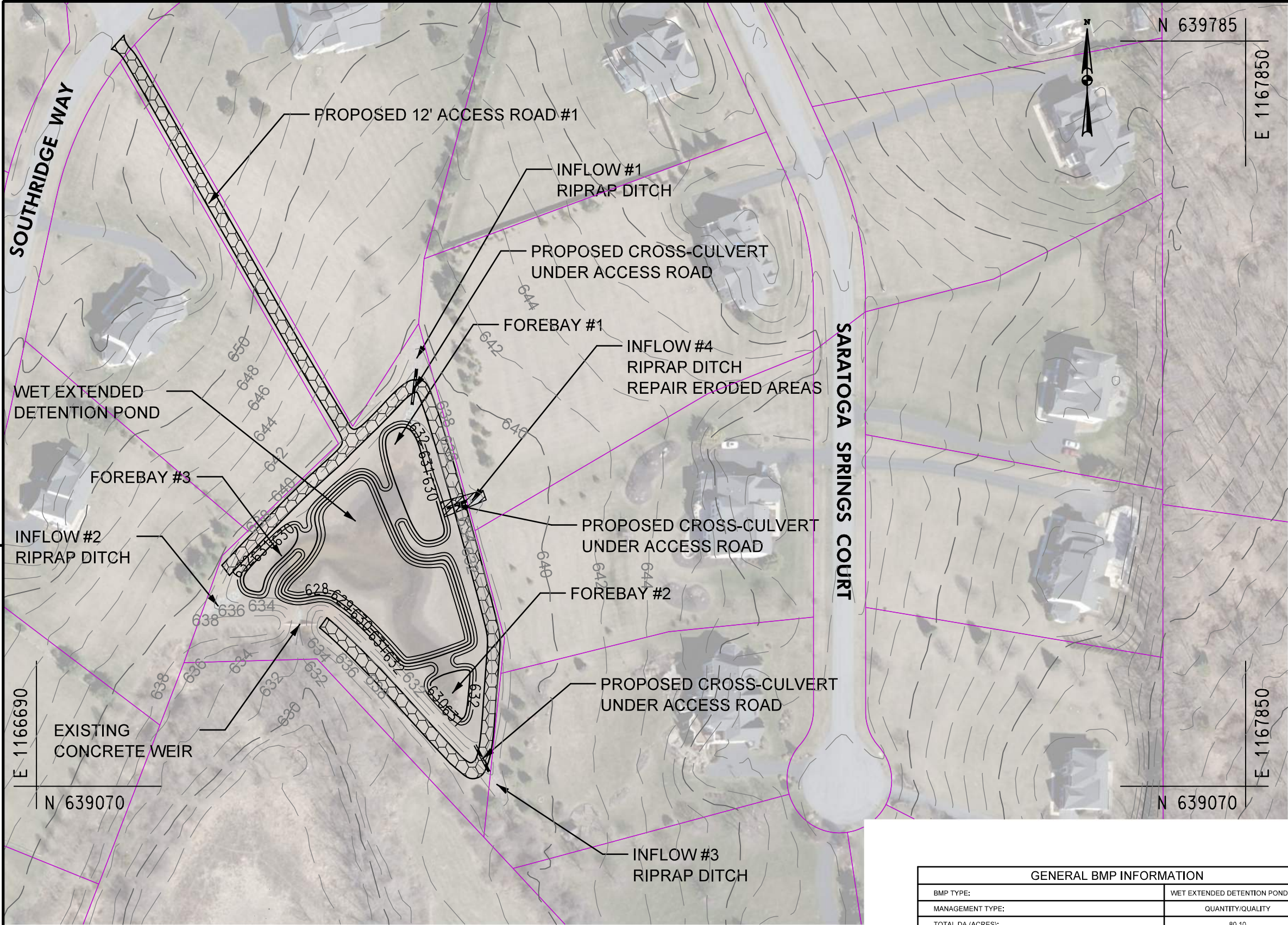
Photo 4: Concrete weir, plunge pool and erosion on downstream embankment looking northeast



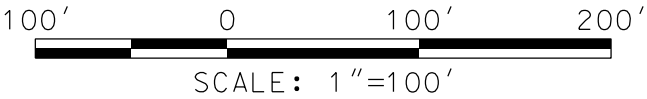
Photo 5: Downstream channel looking south



Photo 6: Inflow #4 erosion and displaced riprap looking southwest



NOTE:
1. THERMAL IMPACTS SHOULD BE EVALUATED DURING FINAL DESIGN.
2. THERE ARE NO EXISTING DRAINAGE EASEMENTS FOR INFLOWS. DRAINAGE EASEMENTS FOR INFLOWS SHOULD BE EVALUATED DURING FINAL DESIGN.



GENERAL BMP INFORMATION	
BMP TYPE:	WET EXTENDED DETENTION POND (P-3)
MANAGEMENT TYPE:	QUANTITY/QUALITY
TOTAL DA (ACRES):	80.10
TOTAL IMPERVIOUS AREA (ACRES):	9.10
WQv REQUIRED (CU. FT):	58153.60
WQv REQUIRED (AC. FT):	1.34
WATER QUALITY TREATMENT PROVIDED	
WQv PROVIDED (CU. FT):	86404.67
TOTAL TREATED DA (ACRES):	80.10
MINIMUM IMPERVIOUS AREA TREATMENT PROVIDED (ACRES):	9.10



Catoctin Creek Watershed Assessment
Frederick County Office of Sustainability
and Environmental Resources
Frederick, MD 21701

BMP #1163

SCALE 1" = 100' ADVERTISED DATE _____ CONTRACT NO. _____

DESIGNED BY VH COUNTY Frederick, MD
DRAWN BY VH LOGMILE _____
CHECKED BY MJ HORIZONTAL SCALE _____
VERTICAL SCALE _____

DRAWING NO. _____ OF _____ SHEET NO. _____ OF _____

LEGEND

- 400 — PARCEL BOUNDARY
- 400 — EXISTING GIS CONTOURS
- 400 — PROPOSED CONTOURS

**Dewberry**[®]
Dewberry Engineers
10461 MILL RUN CIRCLE
SUITE #300
OWINGS MILLS, MARYLAND 21117
PHONE: 410.265.9500
FAX: 410.265.8875

WET EXTENDED DETENTION POND DESIGN (P-3): BMP 1163

This spreadsheet is for **design level calculations** of Wet Extended Detention Pond

Sources for Regulations:

2000 MDE Stormwater Manual Volume I and II

MDE's Accounting Guidance, Accounting of Stormwater Wasteload Allocations, and Impervious Acres Treated (2014)

SWM BMP Retrofit Assessment

Requirement List

Step	Category	Required?	Notes
1	Water Quality Volume (WQv)	Yes	Pe=1.0 min
2	Recharge Volume (Rev)	Yes	Included in WQv
3	Quantity Management	Yes	Maintain Existing Quantity Management

Note: Blue cells in this sheet and "Flows", "Stage-Storage", and "BMP" sheets are user entries

Design Parameters:

Project: Catoctin Creek Watershed Assessment

Engineer: VLH

Location: Frederick County, MD

Date: 9/19/2018

Watershed: Catoctin Creek

As Built:

Drainage Area: 80.10 Acres
(Total)

0.125 square miles

Select Stream Use Classification from drop down menu

Measured Impervious Area: 9.10 Acres

I = 0.114
= 11.4 %

Stream Use: I

Soil Type: B, C

RCN Existing : 64

Existing tc = 0.40 hr

RCN Post Development : 64

Post-D tc = 0.40 hr

Per Frederick County's NPDES SWMF

Step 1: WQv Value

$$WQ_v = \frac{(P)(R_v)(A)}{12}$$

Step 1(a): Compute volumetric Runoff Coefficient(Rv)

$$R_v = 0.05 + (0.009)I = 0.152$$

Step 1(b): Rainfall Zone

Rainfall Zone: P = 1.0 inch (0.9" for Eastern Rainfall Zone, 1.0" for Western Rainfall zone)

Step 1(c): Compute WQv

Water quality required for I = 11.4 %

$$WQ_{V(I)} = 1.016 \text{ ac-ft} = 44268 \text{ cu.ft}$$

Minimum water quality required 0.2 inches per acre of the drainage area,

$$WQ_{V(\text{Min})} = 1.335 \text{ ac-ft} = 58152.6 \text{ cu.ft}$$

Water quality treatment required =	58153	cu.ft =	1.3350	ac-ft	
WQv provided by other practices =	0	cu.ft =	0.0000	ac-ft	
Net water quality treatment required =	58153	cu.ft =	1.3350	ac-ft	
Sediment Forebay Volume Required=	5815	cu.ft =	0.1335	ac-ft	Forebay Volume = 0.1" runoff
WQv in pond =	52337	cu.ft =	1.2015	ac-ft	
Elevation at the Top of WQv in pond =	631.34	ft			

Forebay storage counts toward total WQv requirement.

The Stream Use Classification was used to set WQ_v distribution in forebay, micropool and active storage

For this case: Use Classification= I 50% of WQv is in micropool

Use Classification	Portion of WQv*	WQv in micropool
I	50% of WQv is in micropool	29076
II	50% of WQv is in micropool	29076
III	1/3 of WQv is in micropool & forebay	13569
IV	1/3 of WQv is in micropool & forebay	13569

*source: SHA SWM Workshop, April 30, 2003

$$\text{Micropool storage volume required} = 29076 \text{ cu.ft} = 0.6675 \text{ ac-ft}$$

$$\begin{aligned} \text{Extended Detention Storage} &= 29076 \text{ cu.ft} = \text{Dead Storage Volume} \\ \text{Extended Detention Elevation} &= 630.01 \text{ ft} = \text{Dead Storage EI} = \text{orifice EI. From EI-Storage} \end{aligned}$$

Step 1(d): Water quality release rate

$$\begin{aligned} \text{Minimum WQv release time should be} & 24 \text{ -hr drawdown for the portion of WQv in pond above orifice} \\ \text{Hence, WQrr} &= 0.34 \text{ cfs} \quad \text{WQrr} = \text{Micropool Storage Volume required}/24\text{hrs}/3600\text{sec/hr} \end{aligned}$$

With WQv, determine the required orifice area (A_o) for extended detention design:

$$A_o = \frac{WQrr}{4.81 \sqrt{h_o}}$$

Assume h_o = 1.34 ft *Will change based on pond volume

$$A_o = 0.06 \text{ sf}$$

Determine the required orifice diameter (d_o)

$$D_o = \sqrt{\frac{4 A_o}{\pi}}$$

$$D_o = 0.28 \text{ ft} = 3.3 \text{ inches.}$$

Step 2: Compute Recharge Volume (Rev)

$$Rev = \frac{(S)(Rv)(A)}{12}$$

Step 2(a): Determine Soil Specific Recharge Factor (S) Based on Hydrologic Soil Group

1334950.504

HSG	Soil Specific Recharge Factor (s)
A	0.38
B	0.26
C	0.13
D	0.07

HSG	Drainage Area (Acres)	Percentage (%)
A	0.00	0
B	72.60	91
C	7.50	9
D	0.00	0
Total	80.10	OK: sum of the areas matches site Area

Composite S: 0.2478 Use 24.78 of site imperviousness

Step 2(b): Compute Rev Using Percent Volume Method

Rev = $[(S)(Rv)(A)]/12 =$ 0.252 ac-ft = 10971 cu.ft
 Rev in Pond= 5155
 El of Rev= 628.38 ft from El-storage

Step 2(c): Compute Rev Using Percent Area Method

Rev = (S)(Ai) = 2.255 Acres = 98237 sf

The Rev requirement may be met by:

- a) treating 0.252 ac-ft using structural method,
- b) treating 2.255 acres using non-structural methods, or
- c) a combination of both or it is part of WQv volume if not treated separately.

Project: Catoctin Creek Watershed Assessment Engineer: VLH
 Location: Frederick County, MD Date: 9/19/2018
 Watershed: Catoctin Creek

STAGE-STORAGE CALCULATIONS

POND

$$V = h/3 * [A1 + A2 + \text{SQRT}(A1*A2)]$$

Area (sq.ft)	Elevation (ft)	Area (acres)	Incr. Depth (ft)	Inc. Volume (acre-ft)	TOTAL VOLUME (acre-ft) (cu.ft)	
12817.5	628.0	0.29	0.00	0.00	0.00	0.00
14497.5	629.0	0.33	1.00	0.31	0.31	13648.89
16188.4	630.0	0.37	1.00	0.35	0.67	28984.11
17970.4	631.0	0.41	1.00	0.39	1.06	46055.76
19847.6	632.0	0.46	1.00	0.43	1.49	64956.96
		0.00	1.00	0.15	1.64	71572.82
		0.00	0.00	0.00	0.00	0.00
		0.00	0.00	0.00	0.00	0.00
		0.00	1.00	0.00	0.00	0.00

No. of valid row entries= 5

Project: Catoctin Creek Watershed Assessment Engineer: VLH
 Location: Frederick County, MD Date: 9/19/2018
 Watershed: Catoctin Creek

STAGE-STORAGE CALCULATIONS

FOREBAY #1

$$V = h/3 * [A1 + A2 + \text{SQRT}(A1*A2)]$$

Area (sq.ft)	Elevation (ft)	Area (acres)	Incr. Depth (ft)	Inc. Volume (acre-ft)	TOTAL VOLUME (acre-ft) (cu.ft)	
3284.2	630.0	0.08	0.00	0.00	0.00	0.00
4077.0	631.0	0.09	1.00	0.08	0.08	3673.49
4935.7	632.0	0.11	1.00	0.10	0.19	8173.01
		0.00	0.00	0.00	0.00	0.00
		0.00	0.00	0.00	0.00	0.00

No. of valid row entries= 3

Project: Catoctin Creek Watershed Assessment Engineer: VLH
 Location: Frederick County, MD Date: 9/19/2018
 Watershed: Catoctin Creek

STAGE-STORAGE CALCULATIONS

FOREBAY #2

$$V = h/3 * [A1 + A2 + \text{SQRT}(A1*A2)]$$

Area (sq.ft)	Elevation (ft)	Area (acres)	Incr. Depth (ft)	Inc. Volume (acre-ft)	TOTAL VOLUME (acre-ft) (cu.ft)	
1154.9	630.0	0.03	0.00	0.00	0.00	0.00
1589.7	631.0	0.04	1.00	0.03	0.03	1366.49
2081.1	632.0	0.05	1.00	0.04	0.07	3196.37
		0.00	0.00	0.00	0.00	0.00
		0.00	0.00	0.00	0.00	0.00

No. of valid row entries= 3

Project: Catoctin Creek Watershed Assessment Engineer: VLH
 Location: Frederick County, MD Date: 9/19/2018
 Watershed: Catoctin Creek

STAGE-STORAGE CALCULATIONS

FOREBAY #3

$$V = h/3 * [A1 + A2 + \text{SQRT}(A1*A2)]$$

Area (sq.ft)	Elevation (ft)	Area (acres)	Incr. Depth (ft)	Inc. Volume (acre-ft)	TOTAL VOLUME (acre-ft) (cu.ft)	
1183.7	630.0	0.03	0.00	0.00	0.00	0.00
1724.2	631.0	0.04	1.00	0.03	0.03	1445.47
2324.7	632.0	0.05	1.00	0.05	0.08	3462.47
		0.00	0.00	0.00	0.00	0.00
		0.00	0.00	0.00	0.00	0.00

No. of valid row entries= 3

Project: Catoctin Creek Watershed Assessment
Location: Frederick County, MD
Watershed: Catoctin Creek

Engineer: VLH
Date: 9/19/2018

Water quality treatment required in pond = 52337 cuft
Dead Storage Required, WQvd = 29076 cuft
Elevation at the Top of WQv = 631.89 ft
Dead Storage EI = 630.01 ft
Active Storage to be released= 23261 cuft
Required release duration= 24 hour

Stage - Storage Relationship for SWM Basin

Elevation (ft)	Storage (Cu Ft)	Storage (Ac-Ft)
628.00	0	0.000
629.00	13649	0.313
630.00	28984	0.665
631.00	46056	1.057
632.00	64957	1.491
0.00	71573	1.643
0.00	0	0.000
0.00	0	0.000
0.00	0	0.000

Water Quality Pool Drawdown Time

Remaining water quality volume (not in dead storage or forebay) shall be released in 24-hours, therefore the release rate is,

NOTE: do<3" subject to approval (may require internal control, see App. D.8)

Invert of BMP Opening	180.37 Feet (Elevation)
Dia. of BMP Opening	2.5 Inches
Number of BMP Openings	1#
Total Area of BMP Openings	0.03 Square Feet
Centroid of BMP Opening	180.47 Feet (Elevation)
max release rate	3.49 cfs

BMP Drawdown Time 100.0 Hours
(Based on Incremental Calculations)

Dewberry - WRE

Type II Rainfall

Ia/P	C0	Ci	C2
0.1	2.55323	-0.61512	-0.16403
0.3	2.46532	-0.62257	-0.11657
0.35	2.41896	-0.61594	-0.0882
0.4	2.36409	-0.59857	-0.05621
0.45	2.29238	-0.57005	-0.02281
0.5	2.20282	-0.51599	-0.01259

$$C0 = 2.34210$$

$$Ci = -0.59084$$

$$C2 = -0.04432$$

$$Log(q_u) = C_o + C_i Log(T_c) + C_2 [Log(T_c)]^2$$

qu = 372 csm/in

Storm Water Management Retrofit Evaluation					
Report Date:	3/22/2019	Design Approval:	9/23/1996	Maintenance Owner:	Sheppard Pratt Health Systems
Structure No (NPDES Number):	420	As-Built Date:	7/3/1997	Inspection Date:	5/30/2018
Structure Name:	Sheppard Pratt, SWM Pond #1	NPDES Watershed:	Catoctin Creek	Inspection Team:	MV, JS
		MDE 8 Digit Name/#:	Catoctin Creek (2140305)	Last Significant Rainfall:	5/22/2018 (0.42")
Location:	North of The Jefferson School parking lot off of Point of Rocks Road	Land-River Segment:	B24021PM1_4000_4290	Rainfall Source:	www.wunderground.com
Northing/Easting:	608647.38/1153501.38	Stream Use:	1P	Station:	KMDJEFFE3
BMP Description					
	Existing Condition		Proposed Condition		
General BMP Information					
BMP Type:	Extended Detention Dry Pond		Pocket Sand Filter (F-5)		
BMP Classification:	N/A		Stormwater Treatment (ST) Practice		
Management Type:	Quantity/Quality		Quality		
Total Drainage Area (acres):	4.83		4.72		
Total Impervious Area within Drainage Area (acres):	Unknown		2.25		
WQv Required:	Unknown		8207.37 cu.ft.	0.19 ac.ft.	
Does Facility Meet MDE 2000 WQv Requirements (Y/N):	No		Yes		
Adequate ROW (Y/N):	Yes		Yes		
Adequate Access (Y/N):	No		Yes		
Estimated Treatment Provided		Per Design	Per MDE 2000 Standards		
WQv Provided:	Unknown	0	9225.57 cu.ft.	0.21 ac.ft.	
Total Treated Drainage Area (acres):	4.83	0	4.72		
Minimum Impervious Area Treatment Provided (ac):	Unknown	0	2.25		
Estimated Pollutant Removal Rates					
Minimum Runoff Volume Treated per Impervious Acre (in.)	N/A		1.00		
34.95%					
54.92%					
69.90%					
Estimated Pollutant Load Reduction			Edge of Stream (EOS)	Edge of Tide (EOT)	
TN (lbs/yr):	0		15.37	11.80	
TP (lbs/yr):	0		2.64	1.73	
TSS (lbs/yr):	0		3317.77	1804.44	
Projected Retrofit Cost:				\$82,467.00	

SITE ID: BMP #420

Prioritization Ranking: 4

Planning/Construction Level Cost Estimate: \$82,467.00

Estimated Cost/Impervious Acre: \$36,652.00

General BMP Information		
Structure Location:	North of The Jefferson School parking lot off of Point of Rocks Road	
NPDES Number:	420	
Northing/Easting:	608647.38/1153501.38	
NPDES Watershed:	Catoctin Creek	
MDE 8 Digit Watershed:	Catoctin Creek (2140305)	
Proposed BMP Retrofit General Information		
Proposed BMP Type:	Pocket Sand Filter (F-5)	
Management Type:	Quality	
Total Drainage Area (ac):	4.72	
Total Impervious Area (ac):	2.25	
Water Quality Treatment Provided:		
WQv Provided (cu.ft.):	9225.57	
Total Treated Drainage Area (ac):	4.72	
Minimum Impervious Area Treatment Provided (ac):	2.25	
Estimated Nutrient Reductions:	EOS	EOT
TN (lbs/yr):	15.37	11.80
TP (lbs/yr):	2.64	1.73
TSS (lbs/yr):	3317.77	1804.44



BMP #420

Required Permitting	
Frederick County SWM Review	X
Erosion and Sediment Control (ESC):	X
Grading Permit:	X
Joint Permit Application (JPA)/General Waterway Construction Permit:	
Construction NOI:	
Other:	

EXISTING SITE CONDITIONS

BMP #420 is an existing extended detention dry pond with a 40' concrete weir (Photo 1). The concrete weir has an 8" ALCMP dewatering device and a 2" low flow orifice (Photo 2). The facility outfalls to the north via a riprap ditch (Photo 3). There are two (2) inflows to this facility. Inflow #1 is a 15" HDPE that drains from the rain garden located southwest of the facility. Inflow #2 is a riprap ditch that conveys flow from an 18" HDPE and enters the facility in the southeast corner. There was ponding water in the facility at the time of our field visit. The existing fence surrounding the facility has an access gate located on the west side of the facility. There are no overhead utilities present at the site or along the proposed access road. The surrounding land use is institutional and open urban land.

PROPOSED RETROFIT

The proposed facility type for BMP #420 is a pocket sand filter (F-5) and will provide quality management for 4.72 acres including a minimum impervious area treatment of 2.25 acres. The proposed facility is to be constructed within the existing facility footprint. Two forebays are proposed to capture flow from Inflow #1 and Inflow #2. A drop structure for the inflow pipe may be required and should be evaluated during final design. Grass is proposed as the top layer of the pocket sand filter to reduce maintenance needs. The site can be accessed via the Sheppard Pratt Facility parking lot.

ANTICIPATED SITE CONSTRAINTS

No anticipated site constraints.



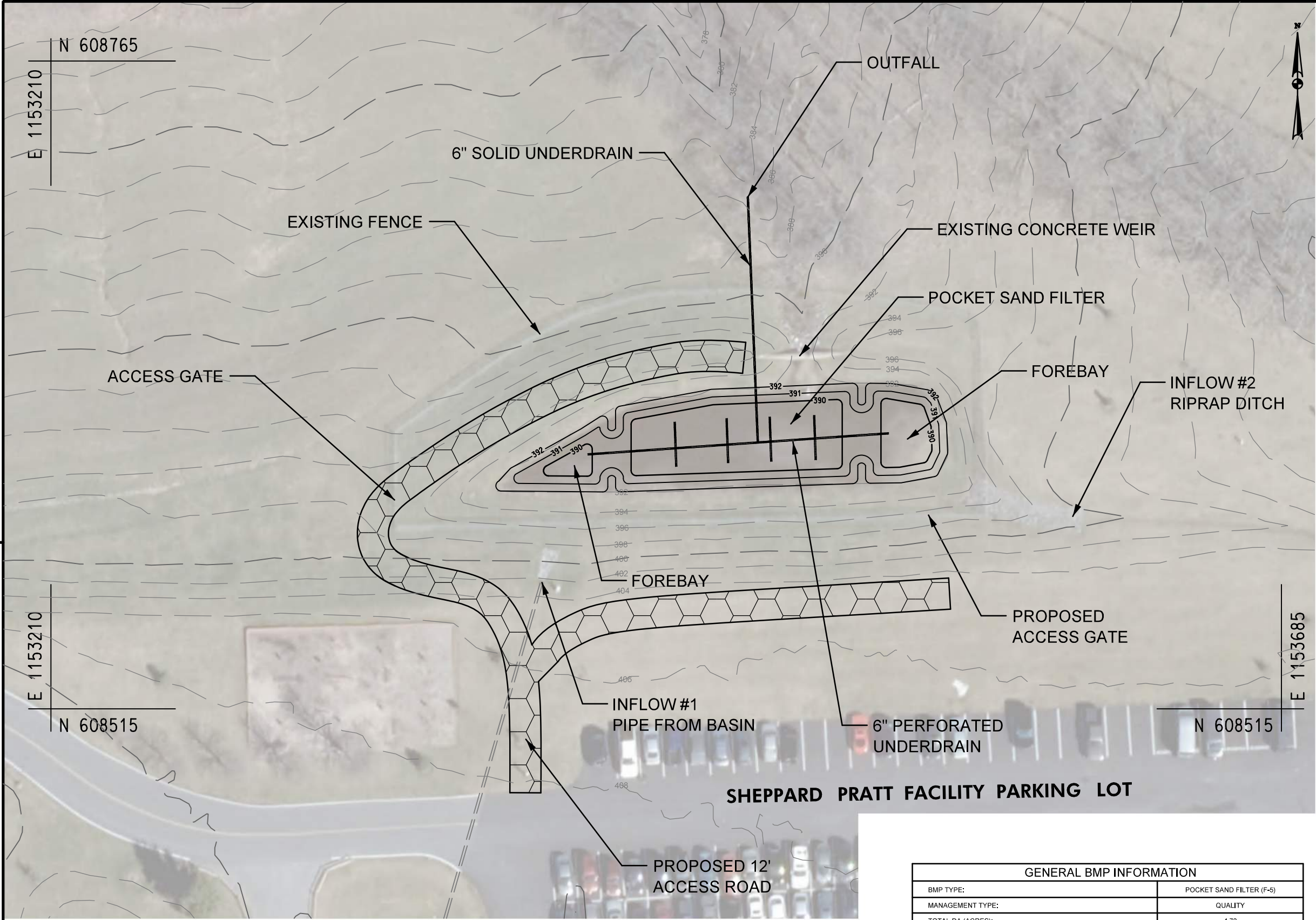
Photo 1: Overall facility looking northeast



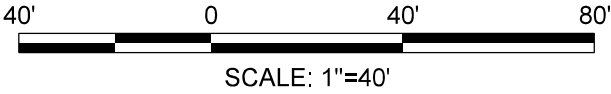
Photo 2: Downstream of concrete weir looking south



Photo 3: Downstream riprap channel looking west



NOTE:
1. A DROP STRUCTURE FOR THE INFLOW PIPE MAY BE REQUIRED AND SHOULD BE EVALUATED DURING FINAL DESIGN.
2. GRASS IS PROPOSED AS THE TOP LAYER OF THE POCKET SAND FILTER TO REDUCE MAINTENANCE NEEDS.



GENERAL BMP INFORMATION	
BMP TYPE:	POCKET SAND FILTER (F-5)
MANAGEMENT TYPE:	QUALITY
TOTAL DA (ACRES):	4.72
TOTAL IMPERVIOUS AREA (ACRES):	2.25
WQv REQUIRED (CU. FT):	8207.37
WQv REQUIRED (AC. FT):	0.1884
WATER QUALITY TREATMENT PROVIDED	
WQv PROVIDED (CU. FT):	9225.57
TOTAL TREATED DA (ACRES):	4.72
MINIMUM IMPERVIOUS AREA TREATMENT PROVIDED (ACRES):	2.25

LEGEND

400

400

400

PARCEL BOUNDARY

EXISTING GIS CONTOURS

PROPOSED CONTOURS

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Dewberry Engineers

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SUITE #300

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FAX: 410.265.8875

FREDERICK COUNTY, MARYLAND

1748

Catoctin Creek Watershed Assessment
Frederick County Office of Sustainability
and Environmental Resources
Frederick, MD 21701

BMP #420

SCALE 1" = 40' ADVERTISED DATE CONTRACT NO.

DESIGNED BY VH COUNTY Frederick, MD

DRAWN BY VH LOGMILE

CHECKED BY MJ HORIZONTAL SCALE

VERTICAL SCALE

DRAWING NO. OF

SHEET NO. OF

BY: vhamsher -

Project: **BMP 420** Pocket Sand Filter (F-5)

Preliminary Design:

Location: **Frederick County, Maryland**

Watershed: **Catoctin Creek**

Stream Use:

Site Area: **4.72** ac **0.00738** sqm

Measured Impervious Area:

$$I = \frac{2.25}{47.67} = 0.477\%$$

Soil Type: **B**

RCN Post Development : **77** **tc = 0.3** hr Per Frederick County's NPDES Database

Step 1: WQv Value

$$WQ_v = \frac{(P)(R_v)(A)}{12}$$

Step 1(a): Compute volumetric Runoff Coefficient(Rv)

$$R_v = 0.05 + (0.009)I = 0.479$$

Step 1(b): Rainfall Zone

Rainfall Zone: Western Rainfall zone with Rainfall (P)= **1** inch

Per MDE's Accounting Guidance, Accounting of Stormwater Wasteload Allocations, and Impervious Acres Treated (2014)

Step 1(c): Compute WQv

Water quality required for I = **48%**

$$WQ_{v(I)} = 0.188 \text{ ac-ft} = 8207 \text{ cft}$$

Minimum water quality required 0.2 inches per acre of the drainage area,

$$WQ_{v(\text{Min})} = 0.079 \text{ ac-ft} = 3426.72 \text{ cft}$$

$$\text{Water quality treatment required} = 8207.3659 \text{ cft} = 0.1884 \text{ ac-ft}$$

Step 1(d): Water Quality Discharge

a. Runoff Volume = $Q_a = P \cdot R_v = 0.47903$ in

b. CN for W_Q storm = **93.55** (from page D.10.1
2000 MDE Stormwater Management Manual)

c. Initial Abstraction = $I_a = (200/\text{CN}) - 2 = 0.14$

d. $I_a/P = 0.14$

e. Unit Peak Discharge = $q_u = 674$ csm/in (Figure D.11.1)

f. Water Quality Peak Flow = $Q_w = (q_u \text{ csm/in}) \cdot (A \text{ mi}^2) \cdot (q_a \text{ in}) = 2.38$ cfs

Step 2: Pretreatment Volume

$$\left(A_s = \frac{Q_o}{W} \times E' \right)$$

Step 2(a) Compute Pretreatment Volume: (25% of WQ_v)

$$\text{Minimum Required } V_p = 2051.84 \text{ cft}$$

Step 2(b) Compute Sedimentation Basin Minimum Surface Area: (A_{sf})

$$A_{sf} = (0.066)(WQ_v), \text{ if } I \leq 75\% = 541.69 \text{ sft}$$

Step 2(c) Design the Sedimentation Basin

Design Width (w) = 33 ft
 Design Length (l) = 35 ft
 Suggested Length to Width Ratio = 2:1
 Required Depth = 1.8 ft
 Design Depth (d) = 2 ft
 Maximum Depth = 2'

Stage - Storage Data for Forebay						
Stage (ft)	Elevation (ft)	Area (sft)	Avg Area (sft)	Incr. (cft)	Storage (cft)	(ac-ft)
0.00	390.00	629.20			0.0	0
			897.56	897.6		
1.00	391.00	1165.93			897.6	0.02061
			1513.15	1513.1		
2.00	392.00	1860.37			2410.7	0.05534

Use a Sedimentation Chamber 33 ft by 35 ft by 2 ft = 2410.7 cft
 (with side slopes of 3:1)

Provided Vp = 2410.7 cft

Step 3: Treatment

Step 3(a) Compute Storage Volume prior to Filtration (including Pretreatment): (75% of WQ_v)

$V_{temp} = 6155.52$ cft

Step 3(b) Compute the Required Filter Bed Area: (A_f)

$$A_f = \frac{(WQ_v)(d_f)}{[k \times (h_f + d_f) \times t_f]}$$

Minimum Filter Bed Depth = 12"

Design Filter Bed Depth (d_f) = 18"
 = 1.50 ft

Filter Media: SHA Bioretention Soil Mix
 Coefficient of Permeability (k) = 2 ft/day

Filter Bed Drain Time (t_f) = 1.67 days

Design Temporary Ponding Height above the Filter Bed (t_p) = 2 ft

Design Average Height of Water above the Filter Bed (h_f) = 1 ft

$A_f = 1474.38$ sft

Step 3(c) Design the Filter Chamber

Setting Width = 26 ft

Required Length = 56.7 ft

Design Length = 82 ft

Use a Filter Chamber 26 ft by 82 ft

Stage - Storage Data for Sand Filter								
Stage	Elevation	Area	Average Area	Incr. Storage	Total Storage		Storage Above Dead Storage	
(ft)	(ft)	(sft)	(sft)	(cft)	(cft)	(ac-ft)	(ac-ft)	(cft)
0.00	390.00	2078.99			0.0	0.0000	0.0000	0.00
			2414.54	2414.5				
1.00	391.00	2750.08			2414.5	0.0554	0.0554	2414.53
			3121.15	3121.2				
2.00	392.00	3492.22			5535.7	0.1271	0.1271	5535.66

$$V_{\text{treatment}} = (t_p \times l \times b) + (d_f \times l \times b \times 0.4)$$

$$= 6814.863023 \text{ cft}$$

Step 4: Check

$V_{\text{total}} = V_p + V_{\text{treatment}} = 9225.57 \text{ cft}$

Required Vtotal = 8207.37 cft

Design Criteria Satisfaction: Yes

Step 5: Compute Recharge Volume (Rev)

Step 5(a) : Determine Soil Specific Recharge Factor (S) Based on Hydrologic Soil Group

HSG	Soil Specific Recharge Factor (s)	
A	0.38	
B	0.26	
C	0.13	
D	0.07	
HSG	Drainage Area (ac)	Percentage (%)
A	0.00	0
B	4.72	100
C	0.00	0
D	0	0
Total	4.72	OK: sum of the area

$$Re \ v = \frac{(S)(Rv)(A)}{12}$$

OK: sum of the areas matches site Area

Composite S: 0.2600 Use 26.00 of site imperviousness

Step 5(b): Compute Rev Using Percent Volume Method

Rev = [(S)(Rv)(A)]/12 = 0.049 ac-ft = 2134 cft

Step 5(c): Compute Rev Using Percent Area Method

Rev = (S)(Ai) = 0.585 ac = 25482 sf

Recharge volume is included in the water quality volume.

The Rev requirement may be met by a) treating 0.049 ac-ft using structural method, b) treating 0.585 acres using non-structural methods, or c) a combination of both or it is part of WQv volume if not treated separately.

Storm Water Management Retrofit Evaluation					
Report Date:	3/22/2019	Design Approval:	9/20/1996	Maintenance Owner:	Sheppard Pratt Health Systems
Structure No (NPDES Number):	421	As-Built Date:	7/3/1997	Inspection Date:	5/30/2018
Structure Name:	Sheppard Pratt, SWM Pond #2	NPDES Watershed:	Catoctin Creek	Inspection Team:	MV, JS
Location:	South of The Jefferson School building off of Point of Rocks Road	MDE 8 Digit Name/#:	Catoctin Creek (2140305)	Last Significant Rainfall:	5/22/2018 (0.42")
Northing/Easting:	607753.07/1153506.42	Land-River Segment:	B24021PM1_4000_4290	Rainfall Source:	www.wunderground.com
		Stream Use:	1P	Station:	KMDJEFFE3
BMP Description					
	Existing Condition			Proposed Condition	
General BMP Information					
BMP Type:	Extended Detention Dry Pond			Pocket Sand Filter (F-5)	
BMP Classification:	N/A			Stormwater Treatment (ST) Practice	
Management Type:	Quantity/Quality			Quality	
Total Drainage Area (acres):	4.15			3.58	
Total Impervious Area within Drainage Area (acres):	Unknown			1.57	
WQv Required:	Unknown			5778.91 cu.ft.	0.13 ac.ft.
Does Facility Meet MDE 2000 WQv Requirements (Y/N):	No			Yes	
Adequate ROW (Y/N):	Yes			Yes	
Adequate Access (Y/N):	No			Yes	
Estimated Treatment Provided		Per Design	Per MDE 2000 Standards		
WQv Provided:	Unknown	0	8299.47 cu.ft.	0.19 ac.ft.	
Total Treated Drainage Area (acres):	4.15	0	3.58		
Minimum Impervious Area Treatment Provided (ac):	Unknown	0	1.57		
Estimated Pollutant Removal Rates					
Minimum Runoff Volume Treated per Impervious Acre (in.)	N/A		1.00		
34.95%					
54.92%					
69.90%					
Total Nitrogen:					
Total Phosphorus:					
Sediment:					
Estimated Pollutant Load Reduction			Edge of Stream (EOS)		Edge of Tide (EOT)
TN (lbs/yr):	0		11.57		8.87
TP (lbs/yr):	0		2.06		1.35
TSS (lbs/yr):	0		2425.91		1319.38
Projected Retrofit Cost:					\$57,543.64

SITE ID: BMP #421

Prioritization Ranking: 5

Planning/Construction Level Cost Estimate: \$57,543.64

Estimated Cost/Impervious Acre: \$36,652.00

<u>General BMP Information</u>		
Structure Location:	South of The Jefferson School building off of Point of Rocks Road	
NPDES Number:	421	
Northing/Easting:	607753.07/1153506.4	
NPDES Watershed:	Catoctin Creek	
MDE 8 Digit Watershed:	Catoctin Creek (2140305)	
<u>Proposed BMP Retrofit General Information</u>		
Proposed BMP Type:	Pocket Sand Filter (F-5)	
Management Type:	Quality	
Total Drainage Area (ac):	3.58	
Total Impervious Area (ac):	1.57	
<u>Water Quality Treatment Provided:</u>		
WQv Provided (cu.ft.):	8299.47	
Total Treated Drainage Area (ac):	3.58	
Minimum Impervious Area Treatment Provided (ac):	1.57	
<u>Estimated Nutrient Reductions:</u>	<u>EOS</u>	<u>EOT</u>
TN (lbs/yr):	11.57	8.87
TP (lbs/yr):	2.06	1.35
TSS (lbs/yr):	2425.91	1319.38



BMP #421

Required Permitting

Frederick County SWM Review	X
Erosion and Sediment Control (ESC):	X
Grading Permit:	X
Joint Permit Application (JPA)/General Waterway Construction Permit:	
Construction NOI:	
Other:	

EXISTING SITE CONDITIONS

BMP #421 is an existing extended detention dry pond with a 35' concrete weir (Photo 1). The concrete weir has an 8" ALCMP dewatering device and a 2" low flow orifice (Photo 2). The facility outfalls to the south via a riprap ditch (Photo 3). There are three (3) inflows to this facility. Inflow #1 is an 18" HDPE entering the facility in the northwest corner. Inflow #2 is a 15" HDPE entering the facility along the western side. Inflow #3 is an 8" CMP trench drain entering the facility in the southwest corner. There is an existing fence surrounding the facility with an access gate located in the northeast corner. There are no overhead utilities present at the site or along the proposed access road. The surrounding land use is institutional and open urban land.

PROPOSED RETROFIT

The proposed facility type for BMP #421 is a pocket sand filter (F-5) which will provide quality management for 3.58 acres including a minimum impervious area treatment of 1.57 acres. The proposed facility will be constructed within the existing facility footprint. One forebay is proposed to capture flow from Inflow #1, Inflow #2 and Inflow #3. The existing fence and access gate will need to be relocated to encompass the proposed access road. Grass is proposed as the top

layer of the pocket sand filter to reduce maintenance needs. The site can be accessed via the Sheppard Pratt Facility driveway.

ANTICIPATED SITE CONSTRAINTS

The existing fence and access gate will need to be relocated to include the proposed access road.



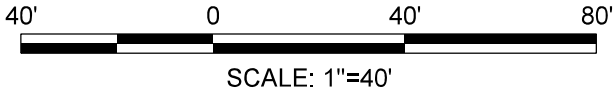
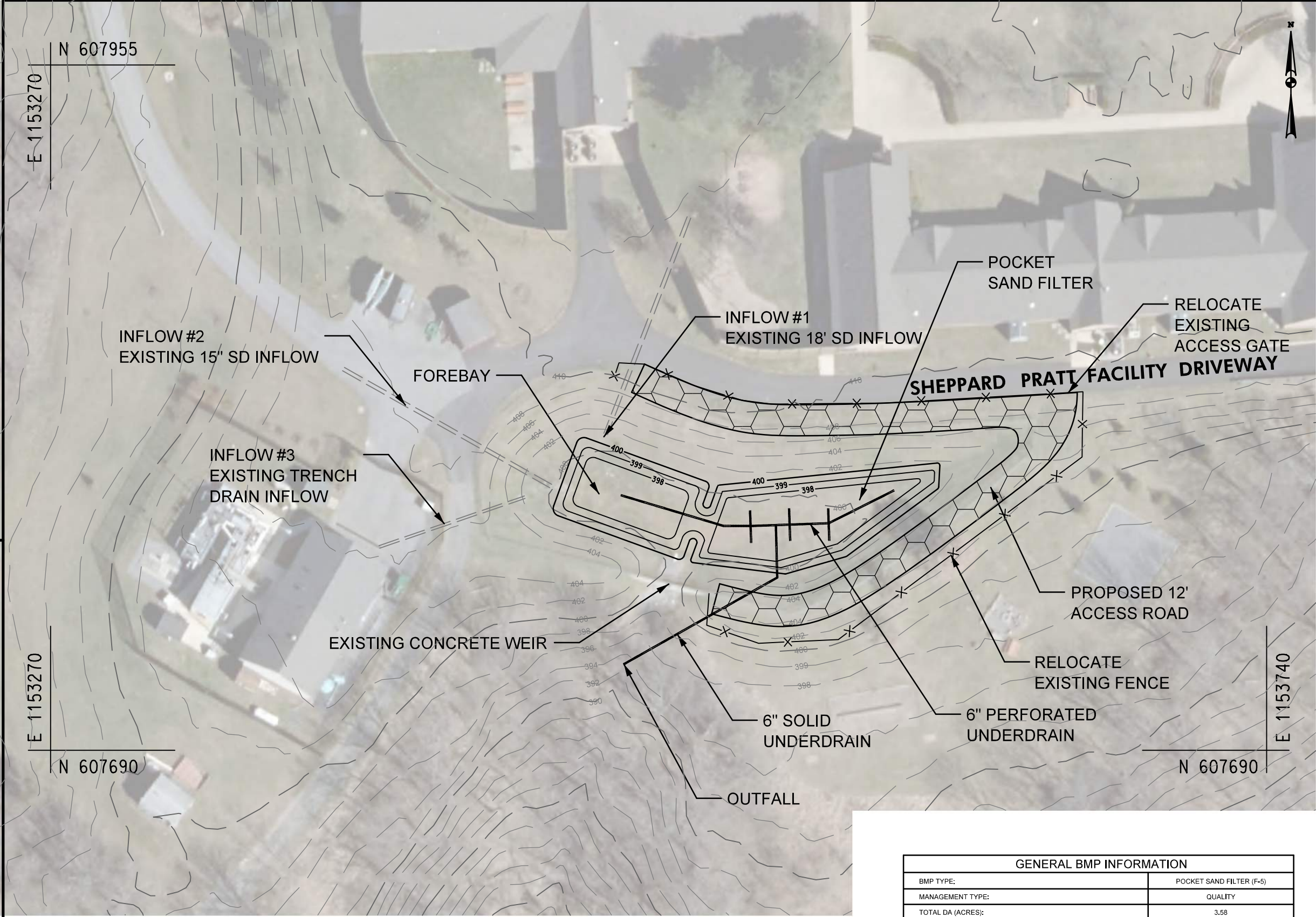
Photo 1: Overall facility looking east



Photo 2: Downstream of concrete weir looking northeast



Photo 3: Downstream riprap channel looking south



Catoctin Creek Watershed Assessment
Frederick County Office of Sustainability
and Environmental Resources
Frederick, MD 21701

BMP #421

SCALE: 1" = 40' ADVERTISED DATE: CONTRACT NO.:


DESIGNED BY: VH COUNTY: Frederick, MD
DRAWN BY: VH LOGMILE:
CHECKED BY: MJ HORIZONTAL SCALE:
VERTICAL SCALE:

DRAWING NO. OF SHEET NO. OF

GENERAL BMP INFORMATION	
BMP TYPE:	POCKET SAND FILTER (F-5)
MANAGEMENT TYPE:	QUALITY
TOTAL DA (ACRES):	3.58
TOTAL IMPERVIOUS AREA (ACRES):	1.57
WQv REQUIRED (CU. FT):	5778.91
WQv REQUIRED (AC. FT):	0.1327
WATER QUALITY TREATMENT PROVIDED	
WQv PROVIDED (CU. FT):	8299.47
TOTAL TREATED DA (ACRES):	3.58
MINIMUM IMPERVIOUS AREA TREATMENT PROVIDED (ACRES):	1.57

LEGEND

- PARCEL BOUNDARY
- EXISTING GIS CONTOURS
- PROPOSED CONTOURS



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10461 MILL RUN CIRCLE
SUITE #300
OWINGS MILLS, MARYLAND 21117
PHONE: 410.265.9500
FAX: 410.265.8875

Project: **BMP 421** Pocket Sand Filter (F-5)

Preliminary Design:

Location: **Frederick County, Maryland**

Watershed: **Catoctin Creek**

Stream Use:

Site Area: **3.58** ac **0.00559** sqm

Measured Impervious Area:

1.57 ac
I = 0.439
= 43.85 %

Soil Type: **B**

RCN Post Development : **82** **tc = 0.3** hr Per Frederick County's NPDES Database

Step 1: WQv Value

$$WQ_v = \frac{(P)(R_v)(A)}{12}$$

Step 1(a): Compute volumetric Runoff Coefficient(Rv)

$$R_v = 0.05 + (0.009)I = \mathbf{0.445}$$

Step 1(b): Rainfall Zone

Rainfall Zone: Western Rainfall zone with Rainfall (P)= **1** inch

Per MDE's Accounting Guidance, Accounting of Stormwater Wasteload Allocations, and Impervious Acres Treated (2014)

Step 1(c): Compute WQv

Water quality required for I = **44%**

$$WQ_{v(I)} = \mathbf{0.133} \text{ ac-ft} = \mathbf{5779} \text{ cft}$$

Minimum water quality required 0.2 inches per acre of the drainage area,

$$WQ_{v(\text{Min})} = \mathbf{0.060} \text{ ac-ft} = \mathbf{2599.08} \text{ cft}$$

$$\text{Water quality treatment required} = \mathbf{5778.9149} \text{ cft} = \mathbf{0.1327} \text{ ac-ft}$$

Step 1(d): Water Quality Discharge

a. Runoff Volume = $Q_a = P \cdot R_v = \mathbf{0.44469}$ in

b. CN for W_Q storm = **92.89** (from page D.10.1
2000 MDE Stormwater Management Manual)

c. Initial Abstraction = $I_a = (200/CN) - 2 = \mathbf{0.15}$

d. $I_a/P = \mathbf{0.15}$

e. Unit Peak Discharge = $q_u = \mathbf{670}$ csm/in (Figure D.11.1)

f. Water Quality Peak Flow = $Q_w = (q_u \text{ csm/in}) \cdot (A \text{ mi}^2) \cdot (q_a \text{ in}) = \mathbf{1.67}$ cfs

Step 2: Pretreatment Volume

$$\left(A_s = \frac{Q_v}{W} \times E' \right)$$

Step 2(a) Compute Pretreatment Volume: (25% of WQ_v)

$$\text{Minimum Required } V_p = \mathbf{1444.73} \text{ cft}$$

Step 2(b) Compute Sedimentation Basin Minimum Surface Area: (A_{sf})

$$A_{sf} = \mathbf{(0.066)(WQ_v), \text{ if } I \leq 75\%}$$
$$= \mathbf{381.41} \text{ sft}$$

Step 2(c) Design the Sedimentation Basin

Design Width (w) = 20 ft Suggested Length to Width Ratio = 2:1
 Design Length (l) = 42 ft

Required Depth = 1.7 ft
 Design Depth (d) = 2 ft Maximum Depth = 2'

Stage - Storage Data for Forebay						
Stage (ft)	Elevation (ft)	Area (sft)	Avg Area (sft)	Incr. (cft)	Storage (cft)	(ac-ft)
0.00	398.00	836.08			0.0	0
			1041.72	1041.7		
1.00	399.00	1247.36			1041.7	0.02391
			1487.93	1487.9		
2.00	400.00	1728.50			2529.7	0.05807

Use a Sedimentation Chamber 20 ft by 42 ft by 2 ft = 2529.7 cft
 (with side slopes of 3:1)

Provided Vp = 2529.7 cft

Step 3: Treatment

Step 3(a) Compute Storage Volume prior to Filtration (including Pretreatment): (75% of WQ_v)

$V_{temp} = 4334.19$ cft

Step 3(b) Compute the Required Filter Bed Area: (A_f)

$$A_f = \frac{(WQ_v)(d_f)}{[k \times (h_f + d_f) \times t_f]}$$

Minimum Filter Bed Depth = 12"

Design Filter Bed Depth (d_f) = 18 "
 = 1.50 ft

Filter Media: SHA Bioretention Soil Mix
 Coefficient of Permeability (k) = 2 ft/day

Filter Bed Drain Time (t_f) = 1.67 days

Design Temporary Ponding Height above the Filter Bed (t_p) = 2 ft

Design Average Height of Water above the Filter Bed (h_f) = 1 ft

$A_f = 1038.13$ sft

Step 3(c) Design the Filter Chamber

Setting Width = 24 ft

Required Length = 43.3 ft

Design Length = 80 ft

Use a Filter Chamber 24 ft by 80 ft

Stage - Storage Data for Sand Filter								
Stage	Elevation	Area	Average Area	Incr. Storage	Total Storage		Storage Above Dead Storage	
(ft)	(ft)	(sft)	(sft)	(cft)	(cft)	(ac-ft)	(ac-ft)	(cft)
0.00	398.00	1503.23			0.0	0.0000	0.0000	0.00
			1776.06	1776.1				
1.00	399.00	2048.88			1776.1	0.0408	0.0408	1776.05
			2841.79	2841.8				
2.00	400.00	3634.69			4617.8	0.1060	0.1060	4617.82

$$V_{\text{treatment}} = (t_p \times l \times b) + (d_f \times l \times b \times 0.4)$$

$$= 5769.821667 \text{ cft}$$

Step 4: Check

$V_{\text{total}} = V_p + V_{\text{treatment}} = 8299.47 \text{ cft}$

Required Vtotal = 5778.91 cft

Design Criteria Satisfaction: Yes

Step 5: Compute Recharge Volume (Rev)

Step 5(a) : Determine Soil Specific Recharge Factor (S) Based on Hydrologic Soil Group

HSG	Soil Specific Recharge Factor (s)	
A	0.38	
B	0.26	
C	0.13	
D	0.07	
HSG	Drainage Area (ac)	Percentage (%)
A	0.00	0
B	3.58	100
C	0.00	0
D	0	0
Total	3.58	OK: sum of the area

$$Re \ v = \frac{(S)(Rv)(A)}{12}$$

OK: sum of the areas matches site Area

Composite S: 0.2600 Use 26.00 of site imperviousness

Step 5(b): Compute Rev Using Percent Volume Method

Rev = [(S)(Rv)(A)]/12 = 0.034 ac-ft = 1503 cft

Step 5(c): Compute Rev Using Percent Area Method

Rev = (S)(Ai) = 0.408 ac = 17781 sf

Recharge volume is included in the water quality volume.

The Rev requirement may be met by a) treating 0.034 ac-ft using structural method, b) treating 0.408 acres using non-structural methods, or c) a combination of both or it is part of WQv volume if not treated separately.

Storm Water Management Retrofit Evaluation						
Report Date:	3/22/2019	Design Approval:	6/25/1993	Maintenance Owner:	Property Management People (c/o Heather)	
Structure No (NPDES Number):	752	As-Built Date:	7/24/1997	Inspection Date:	6/5/2018	
Structure Name:	Cambridge Farms, SWM Pond No. 2	NPDES Watershed:	Catoctin Creek	Inspection Team:	MV, VH	
		MDE 8 Digit Name/#:	Catoctin Creek (2140305)	Last Significant Rainfall:	6/3/2018 (0.18")	
Location:	At the end of the maintenance road from Shelburne Court	Land-River Segment:	B24021PM1_4000_4290	Rainfall Source:	www.wunderground.com	
Northing/Easting:	620707.18/1162862.73	Stream Use:	1P	Station:	KMDJEFFE3	
BMP Description						
	Existing Condition			Proposed Condition		
General BMP Information						
BMP Type:	Extended Detention Dry Pond			Wet Pond (P-2)		
BMP Classification:	N/A			Stormwater Treatment (ST) Practice		
Management Type:	Quantity/Quality			Quantity/Quality		
Total Drainage Area (acres):	172.3			182.63		
Total Impervious Area within Drainage Area (acres):	Unknown			24.19		
WQv Required:	Unknown			132589 cu.ft.	3.04 ac.ft.	
Does Facility Meet MDE 2000 WQv Requirements (Y/N):	No			Yes		
Adequate ROW (Y/N):	Yes			Yes		
Adequate Access (Y/N):	No			Yes		
Estimated Treatment Provided		Per Design	Per MDE 2000 Standards			
WQv Provided:	Unknown	0		160305 cu.ft.	3.68 ac.ft.	
Total Treated Drainage Area (acres):	172.3	0		182.63		
Minimum Impervious Area Treatment Provided (ac):	Unknown	0		24.19		
Estimated Pollutant Removal Rates						
Minimum Runoff Volume Treated per Impervious Acre (in.)	N/A			1.00		
Total Nitrogen:				34.95%		
Total Phosphorus:				54.92%		
Sediment:				69.90%		
Estimated Pollutant Load Reduction				Edge of Stream (EOS)	Edge of Tide (EOT)	
TN (lbs/yr):	0			505.66	388.28	
TP (lbs/yr):	0			88.63	58.22	
TSS (lbs/yr):	0			77636.18	42260.25	
Projected Retrofit Cost:					\$886,611.88	

SITE ID: BMP #752

Prioritization Ranking: 6

Planning/Construction Level Cost Estimate: \$885,512.32

Estimated Cost/Impervious Acre: \$36,652.00

General BMP Information		
Structure Location:	At the end of the maintenance road from Shelburne Court	
NPDES Number:	752	
Northing/Easting:	620707.18/1162862.73	
NPDES Watershed:	Catoctin Creek	
MDE 8 Digit Watershed:	Catoctin Creek (2140305)	
Proposed BMP Retrofit General Information		
Proposed BMP Type:	Wet Pond (P-2)	
Management Type:	Quantity/Quality	
Total Drainage Area (ac):	182.63	
Total Impervious Area (ac):	24.19	
Water Quality Treatment Provided:		
WQv Provided (cu.ft.):	160305	
Total Treated Drainage Area (ac):	182.63	
Minimum Impervious Area Treatment Provided (ac):	24.19	
Estimated Nutrient Reductions:	EOS	EOT
TN (lbs/yr):	505.66	388.28
TP (lbs/yr):	88.63	58.22
TSS (lbs/yr):	77636.18	42260.25



BMP #752

Required Permitting

Frederick County SWM Review	X
Erosion and Sediment Control (ESC):	X
Grading Permit:	X
Joint Permit Application (JPA)/General Waterway Construction Permit:	X
Construction NOI:	X
Other:	

EXISTING SITE CONDITIONS

BMP #752 is an existing in-stream extended detention dry pond (Photos 1 and 2) with an 11' x 6' – 4" concrete riser (Photo 3). The concrete riser has a 7" x 7" low flow orifice and a 60" RCP principal spillway with a concrete endwall. The concrete riser manhole cover is missing. The facility outfalls to the northwest into a plunge pool (Photo 4) which then drains to an existing stream (Photo 5). There are overgrown trees and vegetation in the outfall channel. The facility has six (6) inflows. Inflow #1 is a riprap ditch that drains into Inflow #2, and existing stream, and enters the facility in the southern corner. Inflow #3 is an existing stream that enters the facility in the eastern corner. Inflow #4 is a riprap ditch that drains into Inflow #3. Inflow #5 is a riprap ditch that enters the facility along the western side. Inflow #6 is a riprap ditch that enters the facility in the western corner. There are overgrown trees and vegetation present in all of the inflows. Debris has accumulated on the embankment and around the concrete riser, blocking the low flow orifice. A pilot channel conveys flows from Inflow #2 and Inflow #3 to the concrete riser. There is a 34' emergency spillway located in the northern corner of the facility. There are no overhead utilities present at the site or along the proposed access road. The surrounding land use is medium-density residential and cropland.

PROPOSED RETROFIT

The proposed facility type for BMP #752 is an in-stream wet pond (P-2) which will provide quality and quantity management for 182.63 acres including a minimum impervious area treatment of 24.19 acres. The proposed facility will be constructed within the existing facility footprint. One forebay is proposed to capture flow from six (6) inflows. Flow from Inflow #1, Inflow #5 and Inflow #6 will need to be conveyed underneath the proposed access road via cross-culverts adequately sized to carry flows. The two existing drainage easements from Camden Place and Wallingford Court were evaluated for access but deemed not feasible because they either exceeded the maximum allowable slope and/or due to other site constraints. Thermal impacts to the receiving stream should be considered during final design. The site can be accessed via the Frederick County Pump House maintenance access road.

ANTICIPATED SITE CONSTRAINTS

There are possible access road slope constraints.



Photo 1: Overall facility looking northwest



Photo 2: Overall facility looking southeast



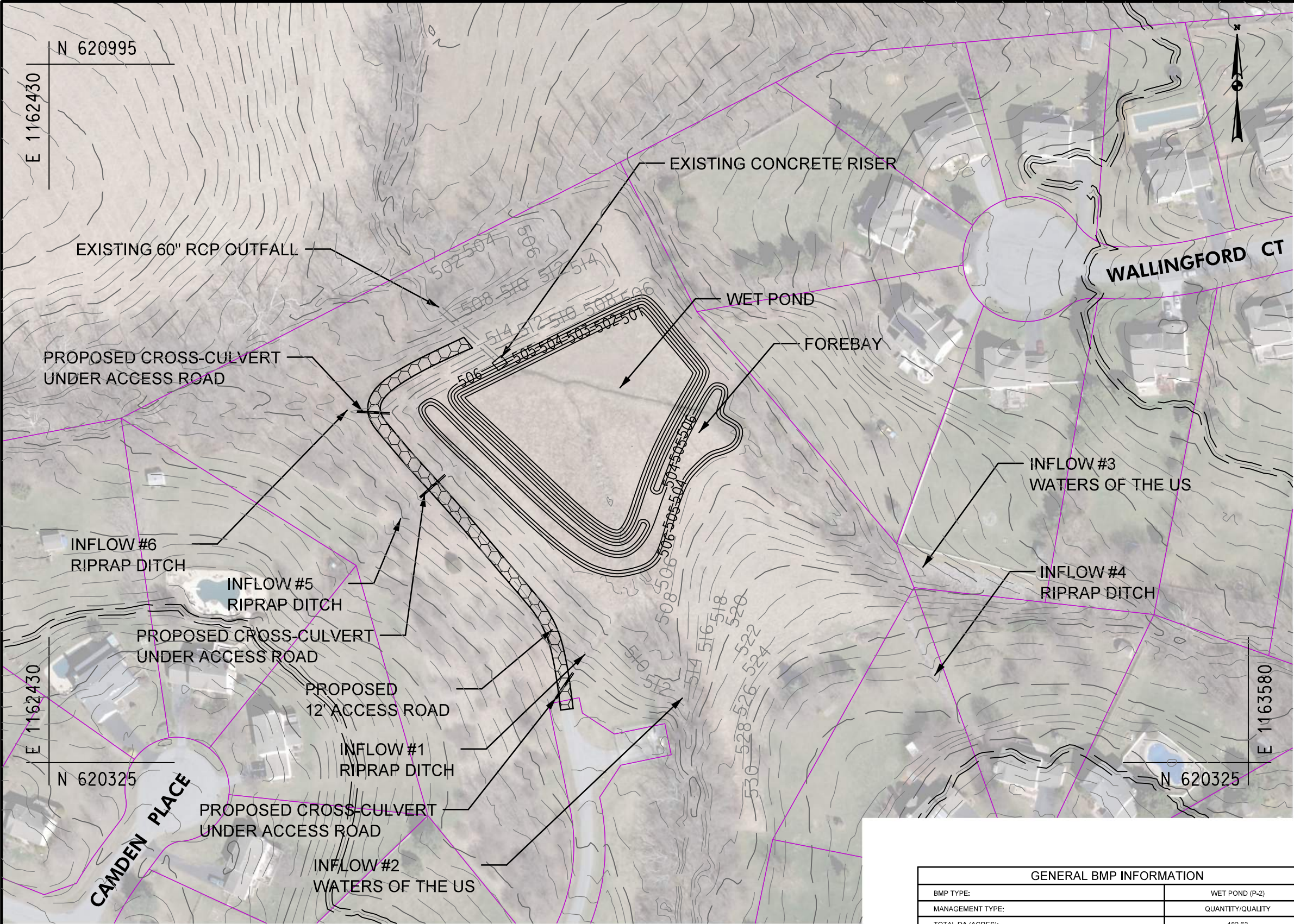
Photo 3: Concrete weir looking southeast



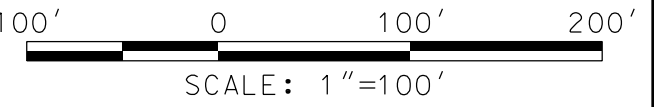
Photo 4: Downstream of 60" RCP principal spillway looking east




Photo 5: Downstream channel looking northwest



NOTE:
1. THERMAL IMPACTS SHOULD BE EVALUATED DURING FINAL DESIGN.
2. THE TWO EXISTING DRAINAGE EASEMENTS FROM CAMDEN PLACE AND WALLINGFORD COURT HAVE BEEN EVALUATED FOR ACCESS BUT DEEMED NOT FEASIBLE DUE TO MAXIMUM ALLOWABLE SLOPE AND SITE CONSTRAINTS.



GENERAL BMP INFORMATION	
BMP TYPE:	WET POND (P-2)
MANAGEMENT TYPE:	QUANTITY/QUALITY
TOTAL DA (ACRES):	182.63
TOTAL IMPERVIOUS AREA (ACRES):	24.19
WQv REQUIRED (CU. FT.):	132589 CU.FT.
WQv REQUIRED (AC. FT.):	3.0438 AC.FT.
WATER QUALITY TREATMENT PROVIDED	
WQv PROVIDED (CU. FT.):	160305 CU.FT.
TOTAL TREATED DA (ACRES):	182.63
MINIMUM IMPERVIOUS AREA TREATMENT PROVIDED (ACRES):	24.19




Catoctin Creek Watershed Assessment
Frederick County Office of Sustainability
and Environmental Resources
Frederick, MD 21701

BMP #752

SCALE: 1"=100' ADVERTISED DATE: CONTRACT NO.:


DESIGNED BY: VH COUNTY: Frederick, MD
DRAWN BY: VH LOGMILE:
CHECKED BY: MJ HORIZONTAL SCALE:
VERTICAL SCALE:


DRAWING NO. OF SHEET NO. OF




Dewberry®
Dewberry Engineers
10461 MILL RUN CIRCLE
SUITE #300
OWINGS MILLS, MARYLAND 21117
PHONE: 410.265.9500
FAX: 410.265.8875

LEGEND

 PARCEL BOUNDARY

 400 EXISTING GIS CONTOURS

 400 PROPOSED CONTOURS

BY: vhamsher -

WET POND DESIGN (P-3): BMP 752

This spreadsheet is for **design level calculations** of Wet Pond

Sources for Regulations:

2000 MDE Stormwater Manual Volume I and II

MDE's Accounting Guidance, Accounting of Stormwater Wasteload Allocations, and Impervious Acres Treated (2014)

SWM BMP Retrofit Assessment

Requirement List

Step	Category	Required?	Notes
1	Water Quality Volume (WQv)	Yes	Pe=1.0 min
2	Recharge Volume (Rev)	Yes	Included in WQv
3	Quantity Management	Yes	Maintain Existing Quantity Management

Note: Blue cells in this sheet and "Flows", "Stage-Storage", and "BMP" sheets are user entries

Design Parameters:

Project: Catoctin Creek Watershed Assessment

Engineer: VLH

Location: Frederick County, MD

Date: 1/31/2019

Watershed: Catoctin Creek

As Built:

Drainage Area: 182.63 Acres
(Total)

0.285 square miles

Select Stream Use Classification from drop down menu

Measured Impervious Area: 24.19 Acres

I = 0.132
= 13.2 %

Stream Use: I

Soil Type: B, C, D

RCN Existing : 72

Existing tc = 0.30 hr

RCN Post Development : 72

Post-D tc = 0.30 hr

Per Frederick County's NPDES SWMF

Step 1: WQv Value

$$WQ_v = \frac{(P)(R_v)(A)}{12}$$

Step 1(a): Compute volumetric Runoff Coefficient(Rv)

$$R_v = 0.05 + (0.009)I = 0.169$$

Step 1(b): Rainfall Zone

Rainfall Zone: P = 1.0 inch (0.9" for Eastern Rainfall Zone, 1.0" for Western Rainfall zone)
1" per MDE's Accounting Guidance, Accounting of Stormwater Wasteload Allocations, and Impervious Acres Treated (2014)

Step 1(c): Compute WQv

Water quality required for I = 13.2 %

$$WQ_{V(I)} = 2.575 \text{ ac-ft} = 112175 \text{ cu.ft}$$

Minimum water quality required 0.2 inches per acre of the drainage area,

$$WQ_{V(\text{Min})} = 3.044 \text{ ac-ft} = 132589.38 \text{ cu.ft}$$

Water quality treatment required =	132589	cu.ft =	3.0438	ac-ft	
WQv provided by other practices =	0	cu.ft =	0.0000	ac-ft	
Net water quality treatment required =	132589	cu.ft =	3.0438	ac-ft	
Sediment Forebay Volume Required=	13259	cu.ft =	0.3044	ac-ft	
WQv in pond =	119330	cu.ft =	2.7395	ac-ft	Forebay Volume = 0.1" runoff
Elevation at the Top of WQv in pond =	505.32	ft			

Forebay storage counts toward total WQv requirement.

The Stream Use Classification was used to set WQv distribution in forebay, micropool and active storage

For this case: Use Classification= I 50% of WQv is in micropool

Use Classification	Portion of WQv*	WQv in micropool
I	50% of WQv is in micropool	66295
II	50% of WQv is in micropool	66295
III	1/3 of WQv is in micropool & forebay	30938
IV	1/3 of WQv is in micropool & forebay	30938

*source: SHA SWM Workshop, April 30, 2003

Step 1(d): Water quality release rate

Minimum WQv release time should be 24 -hr drawdown for the portion of WQv in pond above orifice
Hence, WQrr = 0.77 cfs WQrr = Micropool Storage Volume required/24hrs/3600sec/hr

With WQv, determine the required orifice area (Ao) for extended detention design:

$$A_o = \frac{WQrr}{4.81 \sqrt{h_o}}$$

Assume h_o = 1.76 ft *Will change based on pond volume

$$A_o = 0.12 \text{ sf}$$

Determine the required orifice diameter (d_o)

$$D_o = \sqrt{\frac{4 A_o}{\pi}}$$

$$D_o = 0.39 \text{ ft} = 4.7 \text{ inches.}$$

Step 2: Compute Recharge Volume (Rev)

$$Rev = \frac{(S)(Rv)(A)}{12}$$

Step 2(a): Determine Soil Specific Recharge Factor (S) Based on Hydrologic Soil Group

1334950.504

HSG	Soil Specific Recharge Factor (s)
A	0.38
B	0.26
C	0.13
D	0.07

HSG	Drainage Area (Acres)	Percentage (%)
A	0.00	0
B	160.90	88
C	6.70	4
D	15.36	8
Total	182.96	OK: sum of the areas matches site Area

Composite S: 0.2393 Use 23.93 of site imperviousness

Step 2(b): Compute Rev Using Percent Volume Method

Rev = $[(S)(Rv)(A)]/12 =$ 0.616 ac-ft = 26842 cu.ft
 Rev in Pond= 13583
 El of Rev= 501.56 ft from El-storage

Step 2(c): Compute Rev Using Percent Area Method

Rev = (S)(Ai) = 5.788 Acres = 252140 sf

The Rev requirement may be met by:

- a) treating 0.616 ac-ft using structural method,
- b) treating 5.788 acres using non-structural methods, or
- c) a combination of both or it is part of WQv volume if not treated separately.

Project: Catoctin Creek Watershed Assessment Engineer: VLH
 Location: Frederick County, MD Date: 1/31/2019
 Watershed: Catoctin Creek

STAGE-STORAGE CALCULATIONS

POND

$$V = h/3 * [A1 + A2 + \text{SQRT}(A1*A2)]$$

Area (sq.ft)	Elevation (ft)	Area (acres)	Incr. Depth (ft)	Inc. Volume (acre-ft)	TOTAL VOLUME (acre-ft) (cu.ft)	
23373.5	501.0	0.54	0.00	0.00	0.00	0.00
25292.4	502.0	0.58	1.00	0.56	0.56	24326.64
27270.5	503.0	0.63	1.00	0.60	1.16	50601.89
29305.3	504.0	0.67	1.00	0.65	1.81	78883.66
31396.6	505.0	0.72	1.00	0.70	2.51	109228.59
33544.6	506.0	0.77	1.00	0.75	3.25	141693.25
		0.00	0.00	0.00	0.00	0.00
		0.00	0.00	0.00	0.00	0.00
		0.00	0.00	0.00	0.00	0.00
		0.00	0.00	0.00	0.00	0.00
		0.00	0.00	0.00	0.00	0.00

No. of valid row entries= 6

Project: Catoctin Creek Watershed Assessment Engineer: VLH
 Location: Frederick County, MD Date: 1/31/2019
 Watershed: Catoctin Creek

STAGE-STORAGE CALCULATIONS

FOREBAY

$$V = h/3 * [A1 + A2 + \text{SQRT}(A1*A2)]$$

Area (sq.ft)	Elevation (ft)	Area (acres)	Incr. Depth (ft)	Inc. Volume (acre-ft)	TOTAL VOLUME	
					(acre-ft)	(cu.ft)
6547.7	504.0	0.15	0.00	0.00	0.00	0.00
9328.0	505.0	0.21	1.00	0.18	0.18	7896.95
12166.1	506.0	0.28	1.00	0.25	0.43	18612.61
		0.00	0.00	0.00	0.00	0.00
		0.00	0.00	0.00	0.00	0.00
		0.00	0.00	0.00	0.00	0.00
		0.00	0.00	0.00	0.00	0.00
		0.00	0.00	0.00	0.00	0.00
		0.00	0.00	0.00	0.00	0.00
		0.00	0.00	0.00	0.00	0.00
		0.00	0.00	0.00	0.00	0.00
		0.00	0.00	0.00	0.00	0.00

No. of valid row entries= 3

Storm Water Management Retrofit Evaluation					
Report Date: 3/22/2019		Design Approval: N/A		Maintenance Owner: Miller and Miller Properties LLC	
Structure No: CATO-2018-SPSC-0005		As-Built Date: N/A		Inspection Date: 6/5/2018	
Structure Name: N/A		NPDES Watershed: Catoctin Creek		Inspection Team: MV, VH	
		MDE 8 Digit Name/#: Catoctin Creek (2140305)		Last Significant Rainfall: 6/3/2018 (0.18")	
Location: Within the outfall channel that runs from the SHA outfall behind the apartments off Jefferson Pike to the Route 340 WB ramp.		Land-River Segment: B24021PM1_4000_4290		Rainfall Source: www.wunderground.com	
Northing/Easting: 617500/1161250		Stream Use: 1P		Station: KMDJEFFE3	
BMP Description					
		Existing Condition		Proposed Condition	
General BMP Information					
BMP Type:		No Existing SWM Facility		Regenerative Step Pool Conveyance	
BMP Classification:				Runoff Reduction (RR) Practice	
Management Type:				Quality	
Total Drainage Area (acres):				13.94	
Total Impervious Area within Drainage Area (acres):				4.79	
WQv Required:				18179 cu.ft. 0.42 ac.ft.	
Does Facility Meet MDE 2000 WQv Requirements (Y/N):				Yes	
Adequate ROW (Y/N):				Yes	
Adequate Access (Y/N):				Yes	
Estimated Treatment Provided		Per Design	Per MDE 2000 Standards		
WQv Provided:		No Existing SWM Facility		18179 cu.ft. 0.42 ac.ft.	
Total Treated Drainage Area (acres):				13.94	
Minimum Impervious Area Treatment Provided (ac):				4.79	
Estimated Pollutant Removal Rates					
Minimum Runoff Volume Treated per Impervious Acre (in.)		No Existing SWM Facility		1.00	
Total Nitrogen:				59.75%	
Total Phosphorus:				69.90%	
Sediment:				74.91%	
Estimated Pollutant Load Reduction				Edge of Stream (EOS)	Edge of Tide (EOT)
TN (lbs/yr):		No Existing SWM Facility		70.80	54.15
TP (lbs/yr):				9.58	6.29
TSS (lbs/yr):				8925.17	4854.25
Projected Retrofit Cost:					\$157,437.00

SITE ID: CATO-2018-SPSC-0005

Prioritization Ranking: 7

Planning/Construction Level Cost Estimate: \$157,437.00

Estimated Cost/Impervious Acre: \$32,867.85

<u>General BMP Information</u>		
Structure Location:	Within the outfall channel that runs from the SHA outfall behind the apartments off Jefferson Pike to the Route 340 WB ramp.	
NPDES Number:	N/A	
Northing/Easting:	617500/1161250	
NPDES Watershed:	Catoclin Creek	
MDE 8 Digit Watershed:	Catoclin Creek (2140305)	
<u>Proposed BMP Retrofit General Information</u>		
Proposed BMP Type:	Regenerative Step Pool Conveyance	
Management Type:	Quality	
Total Drainage Area (ac):	13.94	
Total Impervious Area (ac):	4.79	
<u>Water Quality Treatment Provided:</u>		
WQv Provided (cu.ft.):	18179	
Total Treated Drainage Area (ac):	13.94	
Minimum Impervious Area Treatment Provided (ac):	4.79	
<u>Estimated Nutrient Reductions:</u>	<u>EOS</u>	<u>EOT</u>
TN (lbs/yr):	70.80	54.15
TP (lbs/yr):	9.58	6.29
TSS (lbs/yr):	8925.17	4854.25



CATO-2018-SPSC-0005

Required Permitting

Frederick County SWM Review	X
Erosion and Sediment Control (ESC):	X
Grading Permit:	X
Joint Permit Application (JPA)/General Waterway Construction Permit:	
Construction NOI:	X
Other:	

EXISTING SITE CONDITIONS

There is no existing stormwater practice at this site. There is an existing SHA outfall which discharges runoff from Jefferson Pike south of the Valley Dale apartment complex off of Jefferson Pike. Runoff from the outfall flows south through a driveway culvert and into a channel which ultimately flows under Route 340. During storm events, the area below the SHA outfall becomes inundated with water. Water also overtops the downstream driveway. There is an existing fence south of the SHA outfall and north of the driveway. There are no overhead utilities present at the site or along the proposed access road. The surrounding land use is medium-density residential.

PROPOSED RETROFIT

The proposed facility type for CATO-2018-SPSC-0005 is a regenerative step pool conveyance which will provide quality management for 13.94 acres including a minimum impervious area treatment of 4.79 acres. The proposed facility will be

constructed within the existing drainage channel downstream of the SHA outfall. We are proposing 20' cobble cascade/riffles and 10' pools. The length of the proposed regenerative step pool conveyance shown in the concept plan is the minimum length required to provide 1" of water quality treatment from the drainage area. During final design, analysis should be performed to determine where the regenerative step pool conveyance should end and to ensure non-erosive conveyance from the proposed regenerative step pool conveyance to the existing drainage channel. Weirs or check dams are proposed downstream of the regenerative step pool conveyance to further dissipate flow velocities. The regenerative step pool conveyance could be designed to extend through the rest of the property if the property owner is amenable and additional impervious treatment credit can be obtained. Replacement of the existing driveway culvert is proposed as part of the project and should be designed to safely convey existing flows. Removal/replacement of the existing fence should be evaluated during final design in conjunction with discussions with the property owners. The site can be accessed via two access roads, one from the Valley Dale apartment complex parking lot and one from Jefferson Pike via the existing private driveway for the property.

ANTICIPATED SITE CONSTRAINTS

Easement acquisition will be necessary at this site. There is also an existing community garden on the east side of the SHA outfall, south of the Valley Dale apartment complex.



Photo 1: SHA outfall looking north



Photo 2: Area below SHA outfall looking northeast



Photo 3: Driveway culvert looking south

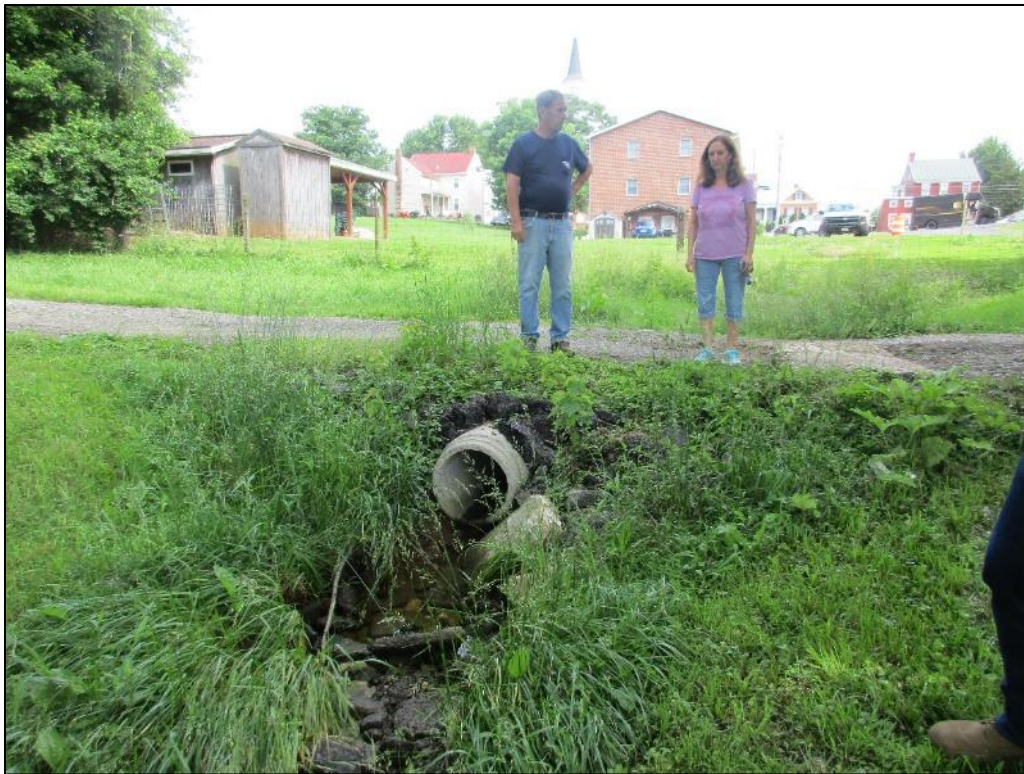


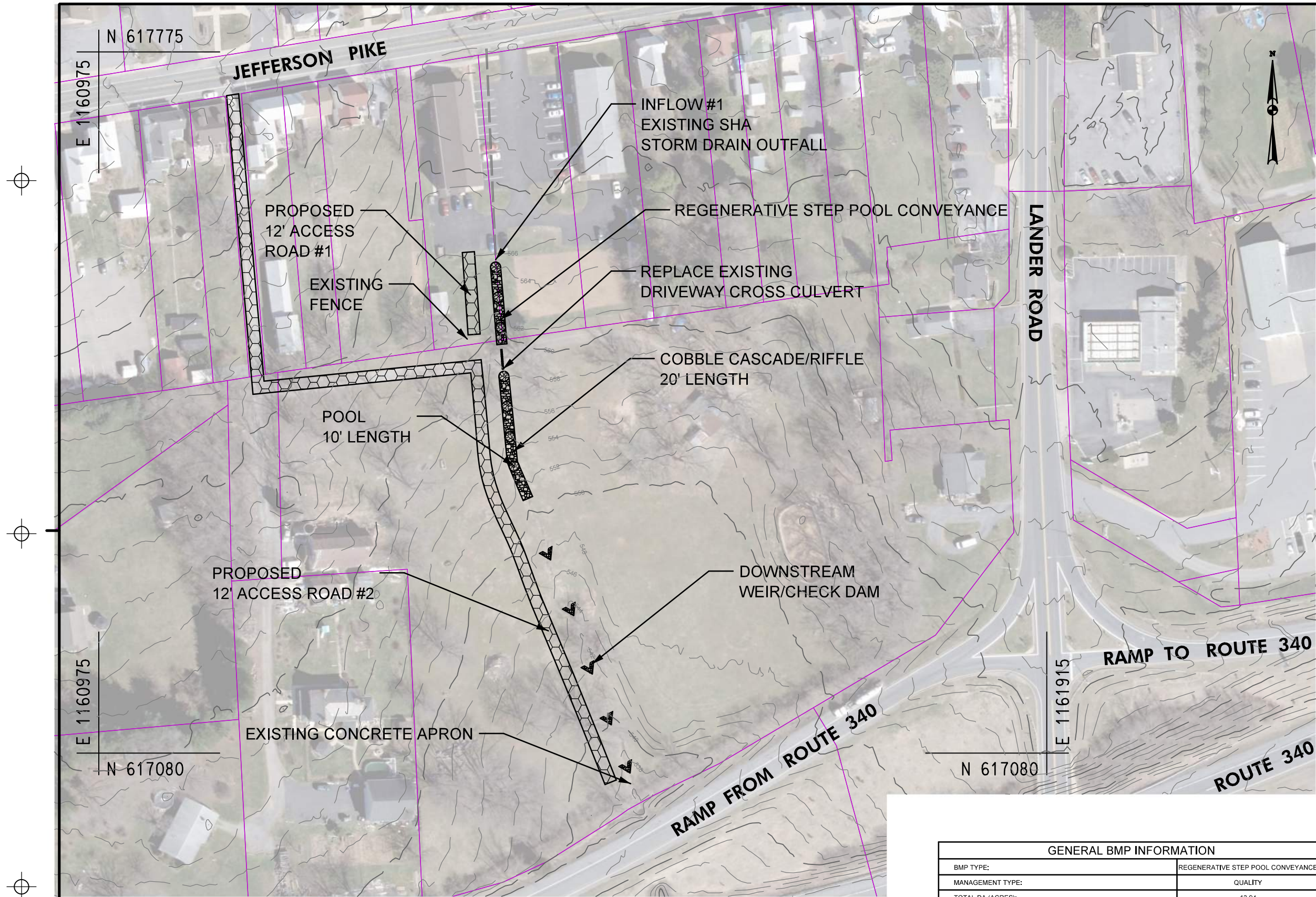
Photo 4: Driveway culvert looking north



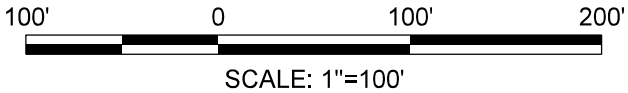
Photo 5: Downstream driveway culvert looking south




Photo 6: Downstream channel looking south



NOTE:
1. DURING FINAL DESIGN, ENSURE NON-EROSIVE CONVEYANCE FROM THE PROPOSED RSC TO THE EXISTING DRAINAGE CHANNEL.
2. THE REGENERATIVE STEP POOL CONVEYANCE LENGTH SHOWN IS BASED OFF OF THE NECESSARY LENGTH REQUIRED TO TREAT FULL WQV. CONTINUATION OF THE REGENERATIVE STEP POOL CONVEYANCE THROUGH THE REST OF THE PROPERTY SHOULD BE CONSIDERED DURING FINAL DESIGN TO DETERMINE IF ADDITIONAL IMPERVIOUS TREATMENT CAN BE OBTAINED.
3. REMOVING OR REPLACING THE EXISTING FENCE SHOULD BE EVALUATED DURING FINAL DESIGN IN CONJUNCTION WITH DISCUSSIONS WITH THE PROPERTY OWNERS.



GENERAL BMP INFORMATION	
BMP TYPE:	REGENERATIVE STEP POOL CONVEYANCE
MANAGEMENT TYPE:	QUALITY
TOTAL DA (ACRES):	13.94
TOTAL IMPERVIOUS AREA (ACRES):	4.79
WQv REQUIRED (CU, FT):	18179
WQv REQUIRED (AC, FT):	0.417
WATER QUALITY TREATMENT PROVIDED	
WQv PROVIDED (CU, FT):	18179
TOTAL TREATED DA (ACRES):	13.94
MINIMUM IMPERVIOUS AREA TREATMENT PROVIDED (ACRES):	4.79




Catoctin Creek Watershed Assessment
Frederick County Office of Sustainability
and Environmental Resources
Frederick, MD 21701

CATO-2018-SPSC-0005

SCALE: 1" = 100' ADVERTISED DATE: CONTRACT NO.:

DESIGNED BY: VH COUNTY: Frederick, MD
DRAWN BY: VH LOGMILE:
CHECKED BY: MJ HORIZONTAL SCALE:
VERTICAL SCALE:

DRAWING NO. OF SHEET NO. OF



Dewberry®
Dewberry Engineers
10461 MILL RUN CIRCLE
SUITE #300
OWINGS MILLS, MARYLAND 21117
PHONE: 410.265.9500
FAX: 410.265.8875

LEGEND

— 400 —

PARCEL BOUNDARY

— 400 —

EXISTING GIS CONTOURS

— 400 —

PROPOSED CONTOURS

BY: vhamsher -

SPSC Design Calculations - Riffle

Refer to "Regenerative Step Pool Storm Conveyance (SPSC) - Design Guidelines [Revision 5: Dec. 2012]"

Plan Name: CATO-2018-SPSC-0005
Plan Number:

Engineer: VLH
Date: 1/16/2019

I. Calculate Design Q (Flow)

	100-YR		10-YR	1-YR
Drainage Area:	13.94	acres	13.94	13.94
C-Factor:	0.74		0.74	0.74
I (Return Period):	7	in/hr	5	2.5
CF	0.99		1.00	1.00
Q design = Flow = CF*C*I*DA =	71.49	cfs		

II. Sizing Conveyance Channel

Step A: Channel Dimensions

Design Slope (S) =	0.05	ft/ft	Note: Start with 5%
Side Slope Ratio =	5	:1	Range from 10:1 to 5:1
Design Depth (D) =	2	ft	
W =	10	ft	8 ft (min.)
d50 (Cobble) =	0.75	ft	Note: Start with 0.5
Area (A) =	$2WD / 3$		= 13.33 SF
Hydraulic Radius (Rh) =	$2W^2D / (3W^2 + 8D^2)$		= 1.205
n =	$D^{1/6} / (21.6 \log(D/d50) + 14)$		= 0.048
Qmax =	$(1.49 / n) * A * Rh^{2/3} * S^{1/2}$		= 103.97 cfs

Adequate
-

Adequate

Step B: Check Maximum Allowable Velocity

g =	32.2	ft/s ²
ys =	185	lb/ft ³
yw =	62.4	lb/ft ³

Max. Allowable Velocity =	$C * [2 * g * ((ys - yw) / yw)]^{1/2} * d50^{1/2}$	
=	8.37	ft/s
=	11.69	ft/s
=	11.69	ft/s
Vmax =	Q / A	= 7.80 ft/s
Fr =	$V / ((g * D)^{1/2})$	= 0.972

Subcritical Flow C = 1.2

Adequate

Step C: Check Actual

dw =	1.706	ft	Note: Use Solver to make Q(act.) = Q(design)		
Wa =	9.24	ft			
A (act.) =	10.51	SF			
Rh (act.) =	$2Wa^2dw / (3Wa^2 + 8dw^2)$		=	1.043	
n(act.) =	$dw^{1/6} / (21.6 * \log(dw/d50) + 14)$		=	0.050	
Q (act.) =	$(1.49 / n) * A * Rh^{2/3} * S^{1/2}$		=	71.49	cfs
Max. Allowable Velocity (act.) =	$C * [2 * g * ((y_s - y_w) / y_w)]^{1/2} * d50^{1/2}$				
=	8.37	ft/s	C = 0.86 (Prevailing Supercritical Flow)		
=	11.69	ft/s	C = 1.2 (Prevailing Subcritical Flow)		
=	8.37	ft/s			
V (act.) =	Q (act.) / A(act.)		=	6.80 ft/s	
Fr(act.) =	V(act.) / ((g*dw)^(1/2))		=	0.92	

Adequate

Supercritical Flow C = 0.86

Adequate

III. Sizing Required Pool Depth

hf (cascade) =	$dw + (V (act.)^2 / 2g) - 0.25$	=	2.1751	=	2.18	ft
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MIN. REQUIRED DEPTH

IV. Water Quality Computations

Site Drainage Area (SA) =	13.94	acres
Contr. Imp. Area (IA) =	4.79	acres
Length Total (L Design) =	210	ft

Rv =	$0.05 + [0.009 * ((IA/SA) * 100)]$	=	0.359	
WQv =	$(Rv * SA / 12) * 43560$	=	18,179	CF

df (pool) =	2	ft	2.0 ft (min.)
df (riffle) =	2	ft	
df (average) =	2	ft	
Wsand =	8	ft	4 ft (min.)
Lsand =	210	ft	Length along project
Af (provided) =	1680	SF	
k =	3.5		
hf =	2.18	ft	
tf =	1.67	days	

Af (required) =	$[WQv * df] / [k * (hf + df) * tf]$	=	1622	SF
-----------------	-------------------------------------	---	------	----

Adequate

Q(design) :	Design Flow
S :	Design Slope
W :	Design Top Width
D :	Design Depth
d50 :	Mean Spherical Diameter
A :	Design Cross Sectional Area
Rh :	Design Hydraulic Area
n :	Design Roughness Coefficient
g :	Specific Gravity
ys :	Density of Stone
yw :	Density of Water
C :	Coefficient of Flow
Vmax :	Maximum Velocity
Fr :	Froude Number based on Design Values
dw :	Normal Depth of Flow
Wa :	Actual Top Width at Normal Depth
A(act.) :	Actual Cross Sectional Area at Normal Depth
Rh(act.) :	Actual Hydraulic Area
n(act.) :	Actual Roughness Coefficient
V(act.) :	Actual Velocity
Fr(act.) :	Froude Number based on Actual Values
hf :	Minimum Depth of Pool

SPSC Design Calculations - Cascade

Refer to "Regenerative Step Pool Storm Conveyance (SPSC) - Design Guidelines [Revision 5: Dec. 2012]"

Plan Name: CATO-2018-SPSC-0005
Plan Number:

Engineer: VLH
Date: 1/16/2019

I. Calculate Design Q (Flow)

	100-YR		10-YR	1-YR
Drainage Area:	13.94	acres	13.94	13.94
C-Factor:	0.74		0.74	0.74
I (Return Period):	7	in/hr	5	2.5
CF	0.99		1.00	1.00
Q design = Flow = CF * C * I * DA =	71.49	cfs		

II. Sizing Conveyance Channel

Step A: Channel Dimensions

Design Slope (S)	0.05	ft/ft	Note: Start with 5%
Side Slope Ratio	5	:1	Range from 10:1 to 5:1
Design Depth (D)	2	ft	
W	10	ft	8 ft (min.)
d50 (Boulder)	1.1	ft	Note: Start with 1.0 (MDSHA Classification)
Area (A)	2WD / 3	=	13.33 SF
Hydraulic Radius (Rh)	2W ² D / (3W ² + 8D ²)	=	1.205
n		=	0.050
Qmax = (1.49 / n) * A * Rh ^{2/3} * S ^{1/2}		=	100.60 cfs

Adequate
-
Class 1

Adequate

Step B: Check Maximum Allowable Velocity

g	32.2	ft/s ²
ys	185	lb/ft ³
yw	62.4	lb/ft ³

Max. Allowable Velocity =	C * [2 * g * ((ys-yw)/yw)] ^{1/2} * d50 ^{1/2}	
=	10.14 ft/s	C = 0.86 (Prevailing Supercritical Flow)
=	14.15 ft/s	C = 1.2 (Prevailing Subcritical Flow)
=	14.15 ft/s	
Vmax = Q / A	=	7.54 ft/s
Fr = V / ((g * D) ^{1/2})	=	0.94

Subcritical Flow C = 1.2

Adequate

Step C: Check Actual

dw	1.70	ft	Note: Use Solver to make Q(act.) = Q(design)
Wa	9.22	ft	
A (act.)	10.45	SF	
Rh (act.) = 2Wa ² dw / (3Wa ² + 8dw ²)		=	1.039
n(act.) =		=	0.05
Q (act.) = (1.49 / n) * A * Rh ^{2/3} * S ^{1/2}		=	71.49 cfs
Max. Allowable Velocity (act.) =	C * [2 * g * ((ys-yw)/yw)] ^{1/2} * d50 ^{1/2}		
=	10.14 ft/s	C = 0.86 (Prevailing Supercritical Flow)	
=	14.15 ft/s	C = 1.2 (Prevailing Subcritical Flow)	
=	14.15 ft/s		
V (act.) = Q (act.) / A (act.)	=	6.84 ft/s	
Fr (act.) = V (act.) / ((g * dw) ^{1/2})	=	0.92	

Adequate

Subcritical Flow C = 1.2

Adequate

III. Sizing Required Pool Depth

hf (cascade) = dw + [V(act) ² / 2g] - 0.25	=	2.1767	=	2.18	ft
---	---	--------	---	------	----

MIN. REQUIRED DEPTH

IV. Water Quality Requirement

Site Drainage Area (SA)	13.94	acres
Contr. Imp. Area (IA)	0.09	acres
Length (Total)	260	ft
Length (Cascades)	117	ft

Rv = 0.05 + [(0.009 * ((SA/IA) * 100))]	=	0.06
WQv = (Rv * SA / 12) * 43560	=	2,813 CF

df (pool) =	1.5	ft	1.5 ft (min.)
df (riffle) =	1.5	ft	
df (average) =	1.5	ft	
Wsand =	6	ft	4 ft (min.)
Lsand =	143	ft	
Af (provided) =	858	SF	
k =	3.5		
hf =	2.18	ft	
tf =	1.67	days	

Af (required) = [WQv * df] / [k * (hf + df) * tf]	=	285.08	SF
---	---	--------	----

Adequate

Q(design)	Design Flow
S	Design Slope
W	Design Top Width
D	Design Depth
d50	Mean Spherical Diameter
A	Design Cross Sectional Area
Rh	Design Hydraulic Area
n	Design Roughness Coefficient
g	Specific Gravity
ys	Density of Stone
yw	Density of Water
C	Coefficient of Flow
Vmax	Maximum Velocity
Fr	Froude Number based on Design Values
dw	Normal Depth of Flow
Wa	Actual Top Width at Normal Depth
A(act.)	Actual Cross Sectional Area at Normal Depth
Rh(act.)	Actual Hydraulic Area
n(act.)	Actual Roughness Coefficient
V(act.)	Actual Velocity
Fr(act.)	Froude Number based on Actual Values
hf	Minimum Depth of Pool

WinTR-55 Current Data Description

--- Identification Data ---

User: VLH Date: 1/31/2019
 Project: Catoctin Watershed Assessmen Units: English
 SubTitle: New Stormwater Opportunities Areal Units: Acres
 State: Maryland
 County: Frederick
 Filename: \\CATOCTIN\Projects\50091117\50091118 - Catoctin Creek Watershed Assessment\Tech\New Stormwater

--- Sub-Area Data ---

Name	Description	Reach	Area(ac)	RCN	Tc
SPSC-0005		Reach	13.94	74	

Total area: 13.94 (ac)

--- Storm Data --

Rainfall Depth by Rainfall Return Period

2-Yr (in)	5-Yr (in)	10-Yr (in)	25-Yr (in)	50-Yr (in)	100-Yr (in)	1-Yr (in)
3.1	4.0	5.0	5.4	6.1	7.0	2.5

Storm Data Source: Frederick County, MD (NRCS)
 Rainfall Distribution Type: Type II
 Dimensionless Unit Hydrograph: <standard>

Storm Water Management Retrofit Evaluation					
Report Date:	3/22/2019	Design Approval:	8/7/2000	Maintenance Owner:	Walter King Plumbing & Heating
Structure No (NPDES Number):	695	As-Built Date:	9/11/2008	Inspection Date:	5/30/2018
Structure Name:	Jefferson Junction Shopping Center - ED Pond	NPDES Watershed:	Catoctin Creek	Inspection Team:	MV, JS
Location:	North of Roundtree Road, west of Lander Road	MDE 8 Digit Name/#:	Catoctin Creek (2140305)	Last Significant Rainfall:	5/22/2018 (0.42")
Northing/Easting:	616338.84/1161620.67	Land-River Segment:	B24021PM1_4000_4290	Rainfall Source:	www.wunderground.com
		Stream Use:	1P	Station:	KMDJEFFE3
BMP Description					
	Existing Condition		Proposed Condition		
General BMP Information					
BMP Type:	Extended Detention Dry Pond		Pocket Pond (P-5)		
BMP Classification:	N/A		Stormwater Treatment (ST) Practice		
Management Type:	Quantity/Quality		Quantity/Quality		
Total Drainage Area (acres):	3		2.15		
Total Impervious Area within Drainage Area (acres):	Unknown		1.46		
WQv Required:	Unknown		5160 cu.ft.	0.12 ac.ft.	
Does Facility Meet MDE 2000 WQv Requirements (Y/N):	No		Yes		
Adequate ROW (Y/N):	Yes		Yes		
Adequate Access (Y/N):	No		Yes		
Estimated Treatment Provided		Per Design	Per MDE 2000 Standards		
WQv Provided:	Unknown	0	8839.32 cu.ft.	0.20 ac.ft.	
Total Treated Drainage Area (acres):	3	0	2.15		
Minimum Impervious Area Treatment Provided (ac):	Unknown	0	1.46		
Estimated Pollutant Removal Rates					
Minimum Runoff Volume Treated per Impervious Acre (in.)			1.00		
Total Nitrogen:	N/A		34.95%		
Total Phosphorus:			54.92%		
Sediment:			69.90%		
Estimated Pollutant Load Reduction			Edge of Stream (EOS)	Edge of Tide (EOT)	
TN (lbs/yr):	0		7.62	5.85	
TP (lbs/yr):	0		1.12	0.74	
TSS (lbs/yr):	0		1821.28	990.54	
Projected Retrofit Cost:					\$53,511.92

SITE ID: BMP #695

Prioritization Ranking: 8

Planning/Construction Level Cost Estimate: \$53,511.92

Estimated Cost/Impervious Acre: \$36,652.00

General BMP Information		
Structure Location:	North of Roundtree Road, west of Lander Road	
NPDES Number:	695	
Northing/Easting:	616338.84/1161620.67	
NPDES Watershed:	Catoctin Creek	
MDE 8 Digit Watershed:	Catoctin Creek (2140305)	
Proposed BMP Retrofit General Information		
Proposed BMP Type:	Pocket Pond (P-5)	
Management Type:	Quantity/Quality	
Total Drainage Area (ac):	2.15	
Total Impervious Area (ac):	1.46	
Water Quality Treatment Provided:		
WQv Provided (cu.ft.):	8839.32	
Total Treated Drainage Area (ac):	2.15	
Minimum Impervious Area Treatment Provided (ac):	1.46	
Estimated Nutrient Reductions:	EOS	EOT
TN (lbs/yr):	7.62	5.85
TP (lbs/yr):	1.12	0.74
TSS (lbs/yr):	1821.28	990.54



BMP #695

Required Permitting

Frederick County SWM Review	X
Erosion and Sediment Control (ESC):	X
Grading Permit:	X
Joint Permit Application (JPA)/General Waterway Construction Permit:	
Construction NOI:	
Other:	

EXISTING SITE CONDITIONS

BMP #695 is an existing extended detention dry pond (Photo 1) with a 3' – 7 1/4" x 3' – 9 1/8" concrete riser (Photo 2). The concrete riser has a 3" low flow orifice and a 24" RCP principal spillway with a concrete end section. The facility outfalls to the southeast into an existing ephemeral channel which then flows south through a 36" x 30" CMP cross-culvert under Roundtree Road. There are significant trees and vegetation in the outfall channel (Photo 3) and substantial damage to the pavement and 36" x 30" CMP cross-culvert (Photo 4). There are two (2) inflows to this facility. Inflow #1 is 24" CMP with a concrete end section that enters the facility in the southwest corner. Inflow #1 is filled with fine gravel. Inflow #2 is a grass ditch that enters the facility in the northern corner. Inflow #2 is experiencing some head-cutting issues. There is an 8' emergency spillway that is located along the eastern side of the facility. There are no overhead utilities present at the site or along the proposed access road. The surrounding land use is commercial.

PROPOSED RETROFIT

The proposed facility type for BMP #695 is a pocket pond (P-5) which will provide quality and quantity management for 2.15 acres including a minimum impervious area treatment of 1.46 acres. The proposed facility will be constructed within the existing facility footprint. One forebay is proposed to capture flow from Inflow #1. The flow from Inflow #2

does not need to be captured in a forebay since the area draining to Inflow #2 is less than 10% of the overall drainage area. Geotechnical borings will be required prior to final design to determine the depth of the water table. High water table or groundwater interception maintains the permanent pool level in a pocket pond. Thermal impacts should be considered during final design. The site can be accessed via the driveway to the Jefferson Junction Shopping Center from Round Tree Road.

ANTICIPATED SITE CONSTRAINTS

There are no anticipated site constraints.



Photo 1: Overall facility looking southwest



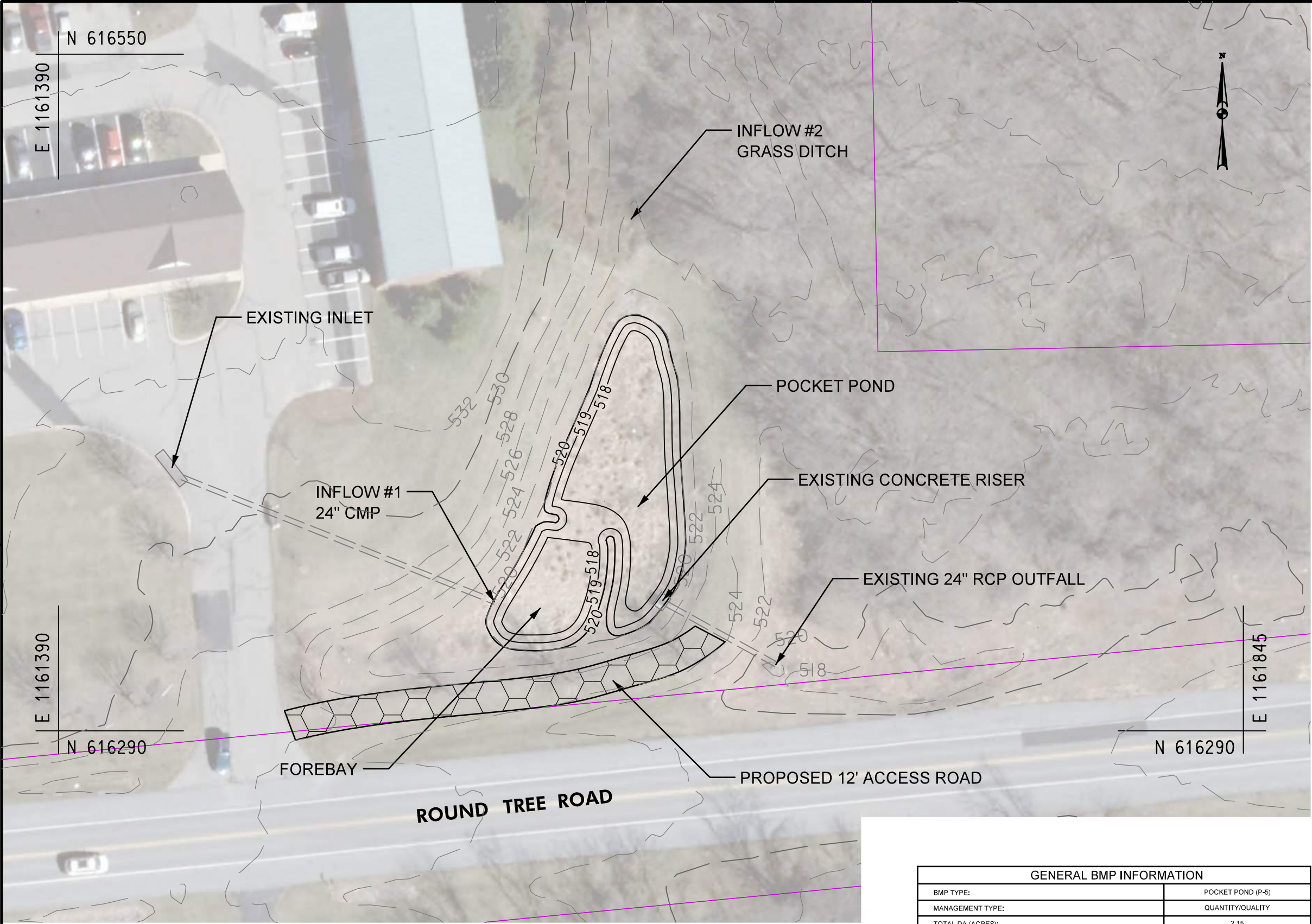
Photo 2: Control structure looking southeast



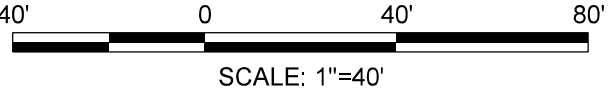
Photo 3: Downstream of 24" RCP principal spillway looking northwest




Photo 4: Cross culvert under Roundtree Road, downstream of facility looking west



NOTE:
1. GEOTECHNICAL BORINGS WILL BE REQUIRED PRIOR TO FINAL DESIGN TO DETERMINE THE DEPTH OF THE WATER TABLE. HIGH WATER TABLE OR GROUNDWATER INTERCEPTION MAINTAINS THE PERMANENT POOL LEVEL IN A POCKET POND.
2. THERMAL IMPACTS SHOULD BE CONSIDERED DURING FINAL DESIGN.



GENERAL BMP INFORMATION	
BMP TYPE:	POCKET POND (P-5)
MANAGEMENT TYPE:	QUANTITY/QUALITY
TOTAL DA (ACRES):	2.15
TOTAL IMPERVIOUS AREA (ACRES):	1.46
WQv REQUIRED (CU. FT):	5160.00
WQv REQUIRED (AC. FT):	0.12
WATER QUALITY TREATMENT PROVIDED	
WQv PROVIDED (CU. FT):	8839.32
TOTAL TREATED DA (ACRES):	2.15
MINIMUM IMPERVIOUS AREA TREATMENT PROVIDED (ACRES):	1.46




Catoclin Creek Watershed Assessment
Frederick County Office of Sustainability
and Environmental Resources
Frederick, MD 21701

BMP #695

SCALE 1"=40' ADVERTISED DATE CONTRACT NO.




DESIGNED BY VH COUNTY Frederick, MD
DRAWN BY VH LOGMILE
CHECKED BY MJ HORIZONTAL SCALE
VERTICAL SCALE

DRAWING NO. OF SHEET NO. OF



Dewberry®
Dewberry Engineers
10461 MILL RUN CIRCLE
SUITE #300
OWINGS MILLS, MARYLAND 21117
PHONE: 410.265.9500
FAX: 410.265.8875

LEGEND

 PARCEL BOUNDARY
 EXISTING GIS CONTOURS
 PROPOSED CONTOURS

POCKET POND DESIGN (P-5): BMP 695

This spreadsheet is for **design level calculations** of Pocket Pond

Sources for Regulations:

2000 MDE Stormwater Manual Volume I and II

MDE's Accounting Guidance, Accounting of Stormwater Wasteload Allocations, and Impervious Acres Treated (2014)

SWM BMP Retrofit Assessment**Requirement List**

Step	Category	Required?	Notes
1	Water Quality Volume (WQv)	Yes	Pe=1.0 min
2	Recharge Volume (Rev)	Yes	Included in WQv
3	Quantity Management	Yes	Maintain Existing Quantity Management

Note: Blue cells in this sheet and "Flows", "Stage-Storage", and "BMP" sheets are user entries

Design Parameters:

Project: Catoctin Creek Watershed Assessment

Engineer: VLH

Location: Frederick County, MD

Date: 2/5/2019

Watershed: Catoctin Creek

As Built:

Drainage Area: 2.15 Acres
(Total)

0.003 square miles

Select Stream Use Classification from drop down menu

Measured Impervious Area: 1.46 Acres

I = 0.679
= 67.9 %

Stream Use: I

Soil Type: B, C, D

RCN Existing : 86

Existing tc = 0.10 hr

RCN Post Development : 86

Post-D tc = 0.10 hr

Per Frederick County's NPDES SWMF

Step 1: WQv Value

$$WQ_v = \frac{(P)(R_v)(A)}{12}$$

Step 1(a): Compute volumetric Runoff Coefficient(Rv)

$$R_v = 0.05 + (0.009)I = 0.661$$

Step 1(b): Rainfall Zone

Rainfall Zone: P = 1.0 inch (0.9" for Eastern Rainfall Zone, 1.0" for Western Rainfall zone)
1" per MDE's Accounting Guidance, Accounting of Stormwater Wasteload Allocations, and Impervious Acres Treated (2014)

Step 1(c): Compute WQv

Water quality required for I = 67.9 %

$$WQ_{V(I)} = 0.118 \text{ ac-ft} = 5160.00 \text{ cu.ft}$$

Minimum water quality required 0.2 inches per acre of the drainage area, 1

$$WQ_{V(\text{Min})} = 0.036 \text{ ac-ft} = 1560.9 \text{ cu.ft}$$

Water quality treatment required =	5160	cu.ft =	0.1185	ac-ft
WQv provided by other practices =	0	cu.ft =	0.0000	ac-ft
Net water quality treatment required =	5160	cu.ft =	0.1185	ac-ft
Sediment Forebay Volume Required=	516	cu.ft =	0.0118	ac-ft
WQv in pond =	4644	cu.ft =	0.1066	ac-ft
Elevation at the Top of WQv in pond =	519.58	ft		

Forebay Volume = 0.1" runoff

Forebay storage counts toward total WQv requirement.

The Stream Use Classification was used to set WQv distribution in forebay, micropool and active storage

For this case: Use Classification= I 50% of WQv is in micropool

Use Classification	Portion of WQv*	WQv in micropool
I	50% of WQv is in micropool	2580
II	50% of WQv is in micropool	2580
III	1/3 of WQv is in micropool & forebay	1204
IV	1/3 of WQv is in micropool & forebay	1204

*source: SHA SWM Workshop, April 30, 2003

Step 1(d): Water quality release rate

Minimum WQv release time should be 24 -hr drawdown for the portion of WQv in pond above orifice
Hence, $WQ_{rr} = 0.03$ cfs $WQ_{rr} = \text{Micropool Storage Volume required} / 24\text{hrs} / 3600\text{sec/hr}$

With WQv, determine the required orifice area (Ao) for extended detention design:

$$A_o = \frac{WQ_{rr}}{4.81 \sqrt{h_o}}$$

Assume $h_o = \text{\#NUM!}$ ft *Will change based on pond volume

$A_o = \text{\#NUM!}$ sf

Determine the required orifice diameter (d_o)

$$D_o = \sqrt{\frac{4 A_o}{\pi}}$$

$D_o = \text{\#NUM!}$ ft = \#NUM! inches.

Step 2: Compute Recharge Volume (Rev)

$$Rev = \frac{(S)(Rv)(A)}{12}$$

Step 2(a): Determine Soil Specific Recharge Factor (S) Based on Hydrologic Soil Group

1334950.504

HSG	Soil Specific Recharge Factor (s)
A	0.38
B	0.26
C	0.13
D	0.07

HSG	Drainage Area (Acres)	Percentage (%)
A	0.00	0
B	1.75	81
C	0.31	14
D	0.09	4
Total	2.15	OK: sum of the areas matches site Area

Composite S: 0.2333 Use 23.33 of site imperviousness

Step 2(b): Compute Rev Using Percent Volume Method

Rev = $[(S)(Rv)(A)]/12 =$ 0.028 ac-ft = 1204 cu.ft
 Rev in Pond= 688
 El of Rev= 518.25 ft from El-storage

Step 2(c): Compute Rev Using Percent Area Method

Rev = (S)(Ai) = 0.341 Acres = 14837 sf

The Rev requirement may be met by:

- a) treating 0.028 ac-ft using structural method,
- b) treating 0.341 acres using non-structural methods, or
- c) a combination of both or it is part of WQv volume if not treated separately.

Project: Catoctin Creek Watershed Assessment Engineer: VLH
 Location: Frederick County, MD Date: 2/5/2019
 Watershed: Catoctin Creek

STAGE-STORAGE CALCULATIONS

POND

$$V = h/3 * [A1 + A2 + \text{SQRT}(A1*A2)]$$

Area (sq.ft)	Elevation (ft)	Area (acres)	Incr. Depth (ft)	Inc. Volume (acre-ft)	TOTAL VOLUME (acre-ft) (cu.ft)	
2319.9	518.0	0.05	0.00	0.00	0.00	0.00
3145.0	519.0	0.07	1.00	0.06	0.06	2722.00
4013.7	520.0	0.09	1.00	0.08	0.14	6292.55
		0.00	0.00	0.00	0.00	0.00
		0.00	0.00	0.00	0.00	0.00
		0.00	0.00	0.00	0.00	0.00
		0.00	0.00	0.00	0.00	0.00
		0.00	0.00	0.00	0.00	0.00
		0.00	0.00	0.00	0.00	0.00
		0.00	0.00	0.00	0.00	0.00
		0.00	0.00	0.00	0.00	0.00
		0.00	0.00	0.00	0.00	0.00

No. of valid row entries= 3

Project: Catoctin Creek Watershed Assessment Engineer: VLH
 Location: Frederick County, MD Date: 2/5/2019
 Watershed: Catoctin Creek

STAGE-STORAGE CALCULATIONS

FOREBAY

$$V = h/3 * [A1 + A2 + \text{SQRT}(A1*A2)]$$

Area (sq.ft)	Elevation (ft)	Area (acres)	Incr. Depth (ft)	Inc. Volume (acre-ft)	TOTAL VOLUME	
					(acre-ft)	(cu.ft)
885.6	518.0	0.02	0.00	0.00	0.00	0.00
1264.7	519.0	0.03	1.00	0.02	0.02	1069.56
1700.4	520.0	0.04	1.00	0.03	0.06	2546.77
		0.00	0.00	0.00	0.00	0.00
		0.00	0.00	0.00	0.00	0.00
		0.00	0.00	0.00	0.00	0.00
		0.00	0.00	0.00	0.00	0.00
		0.00	0.00	0.00	0.00	0.00
		0.00	0.00	0.00	0.00	0.00
		0.00	0.00	0.00	0.00	0.00
		0.00	0.00	0.00	0.00	0.00
		0.00	0.00	0.00	0.00	0.00

No. of valid row entries= 3

Storm Water Management Retrofit Evaluation						
Report Date:	3/22/2019	Design Approval:	4/22/1990	Maintenance Owner:	Prop. Mntg. People (c/o:Heather Maultsby)	
Structure No (NPDES Number):	29	As-Built Date:*	12/20/1995	Inspection Date:	5/1/2018	
Structure Name:	Cambridge Farms, SWM Pond No. 1	NPDES Watershed:	Catoctin Creek	Inspection Team:	MV, JS	
Location:	Northwest of Amesbury Way	MDE 8 Digit Name/#:	Catoctin Creek (2140305)	Last Significant Rainfall:	4/27/2018 (0.39")	
Northing/Easting:	618831.80/1161128.17	Land-River Segment:	B24021PM1_4000_4290	Rainfall Source:	www.wunderground.com	
		Stream Use:	IP	Station:	KMDJEFFE3	
BMP Description						
		Existing Condition		Proposed Condition		
General BMP Information						
BMP Type:	Extended Detention Dry Pond		Surface Sand Filter			
BMP Classification:	N/A		Stormwater Treatment (ST) Practice			
Management Type:	Quantity/Quality		Quality			
Total Drainage Area (acres):	32.36		29.14			
Total Impervious Area within Drainage Area (acres):	Unknown		7.53			
WQv Required:	Unknown		29889.19 cu.ft.		0.69 ac.ft.	
Does Facility Meet MDE 2000 WQv Requirements (Y/N):	No		Yes			
Adequate ROW (Y/N):	Yes		Yes			
Adequate Access (Y/N):	No		Yes			
Estimated Treatment Provided		Per Design	Per MDE 2000 Standards			
WQv Provided:	Unknown	0	143210.77 cu.ft.	3.29 ac.ft.		
Total Treated Drainage Area (acres):	32.36	0	29.14			
Minimum Impervious Area Treatment Provided (ac):	Unknown	0	7.53			
Estimated Pollutant Removal Rates						
Minimum Runoff Volume Treated per Impervious Acre (in.)	N/A		1.00			
34.95%						
54.92%						
69.90%						
Total Nitrogen:						
Total Phosphorus:						
Sediment:						
Estimated Pollutant Load Reduction				Edge of Stream (EOS)	Edge of Tide (EOT)	
TN (lbs/yr):	0		86.08		66.07	
TP (lbs/yr):	0		17.00		11.15	
TSS (lbs/yr):	0		15945.59		8672.32	
Projected Retrofit Cost:					\$564,524.10	

*As-Built Date from the NPDES Database does not match the as-built date shown on the as-built plans.

SITE ID: BMP #29

Prioritization Ranking: 9

Planning/Construction Level Cost Estimate: \$564,524.10

Estimated Cost/Impervious Acre: \$74,970.00

General BMP Information		
Structure Location:	Northwest of Amesbury Way	
NPDES Number:	29	
Northing/Easting:	618831.80/1161128.17	
NPDES Watershed:	Catoctin Creek	
MDE 8 Digit Watershed:	Catoctin Creek (2140305)	
Proposed BMP Retrofit General Information		
Proposed BMP Type:	Surface Sand Filter	
Management Type:	Quality	
Total Drainage Area (ac):	29.14	
Total Impervious Area (ac):	7.53	
Water Quality Treatment Provided:		
WQv Provided (cu.ft.):	143210.77	
Total Treated Drainage Area (ac):	29.14	
Minimum Impervious Area Treatment Provided (ac):	7.53	
Estimated Nutrient Reductions:	EOS	EOT
TN (lbs/yr):	86.08	66.07
TP (lbs/yr):	17.00	11.15
TSS (lbs/yr):	15945.59	8672.32



BMP #29

Required Permitting

Frederick County SWM Review	X
Erosion and Sediment Control (ESC):	X
Grading Permit:	X
Joint Permit Application (JPA)/General Waterway Construction Permit:	
Construction NOI:	X
Other:	

EXISTING SITE CONDITIONS

BMP #29 is an existing extended detention dry pond (Photo 1) with an 11' x 3' concrete riser. The concrete riser has an 8" low flow orifice and a twin 42" BCCMPs principal spillway that outfalls west of the facility. The concrete riser is missing the manhole cover and there is ponding downstream of the twin 42" BCCMPs (Photos 2 and 3). There are five (5) inflows to this facility. Inflow #1 is a 24" CMP with a concrete headwall in the southeast corner of the facility. Inflow #2 is a 24" CMP with a concrete headwall on the east side of the facility. Inflow #3 is a 36" RCP with a concrete endwall along Champlaine Drive which drains into a grass ditch that enters the facility in the northeast corner. Inflow #4 is an 18" CMP cross-culvert under the driveway for Cambridge Farms Park which drains to a grass ditch and enters the facility in the northeast corner at the same location as Inflow #3. Inflow #5 is a grass ditch that enters the facility in the northwest corner. There is an emergency spillway located south of the control structure in the southwest corner of the facility. There is an 8" sanitary sewer that runs perpendicular to Champlaine Drive north of the facility. There are no overhead utilities present at the site or along the proposed access road. The surrounding land use is high-density residential and open urban land.

PROPOSED RETROFIT

The proposed facility type for BMP #29 is an enhanced surface sand filter designed per *Carroll County Supplement to the Maryland Stormwater Design Manual Volumes I & II*. The proposed facility will provide quality management for 29.14 acres including a minimum impervious area treatment of 7.53 acres. The proposed facility will be constructed within the existing facility footprint. Three stilling basins are proposed and are to be placed downstream of Inflow #1, Inflow #2 and Inflows #3/#4 (where the inflow channels meet the facility). Stilling basin size is determined using the size of the inflow pipe. The existing facility bottom may need to be raised in order to outfall the facility and should be evaluated during final design. Per our analysis of available design plans and GIS contours, the current principal spillway outfalls at an approximate elevation of 558'. The approximate depth required to outfall the underdrain for the proposed facility is 3.33' per *Carroll County Supplement to the Maryland Stormwater Design Manual Volumes I & II*. As such, the raised facility bottom would need to be at 561.33'. This elevation and an assumed depth of 2' for quality storage was used to determine quality sizing in our computations. The facility size and embankment height will need to be evaluated during final design to determine quantity storage. Removal of the existing riser should be evaluated during final design. The site can be accessed via the Cambridge Farms Park driveway off of Champlaine Drive.

ANTICIPATED SITE CONSTRAINTS

There is an 8" sanitary sewer that runs perpendicular to Champlaine Drive north of the facility.



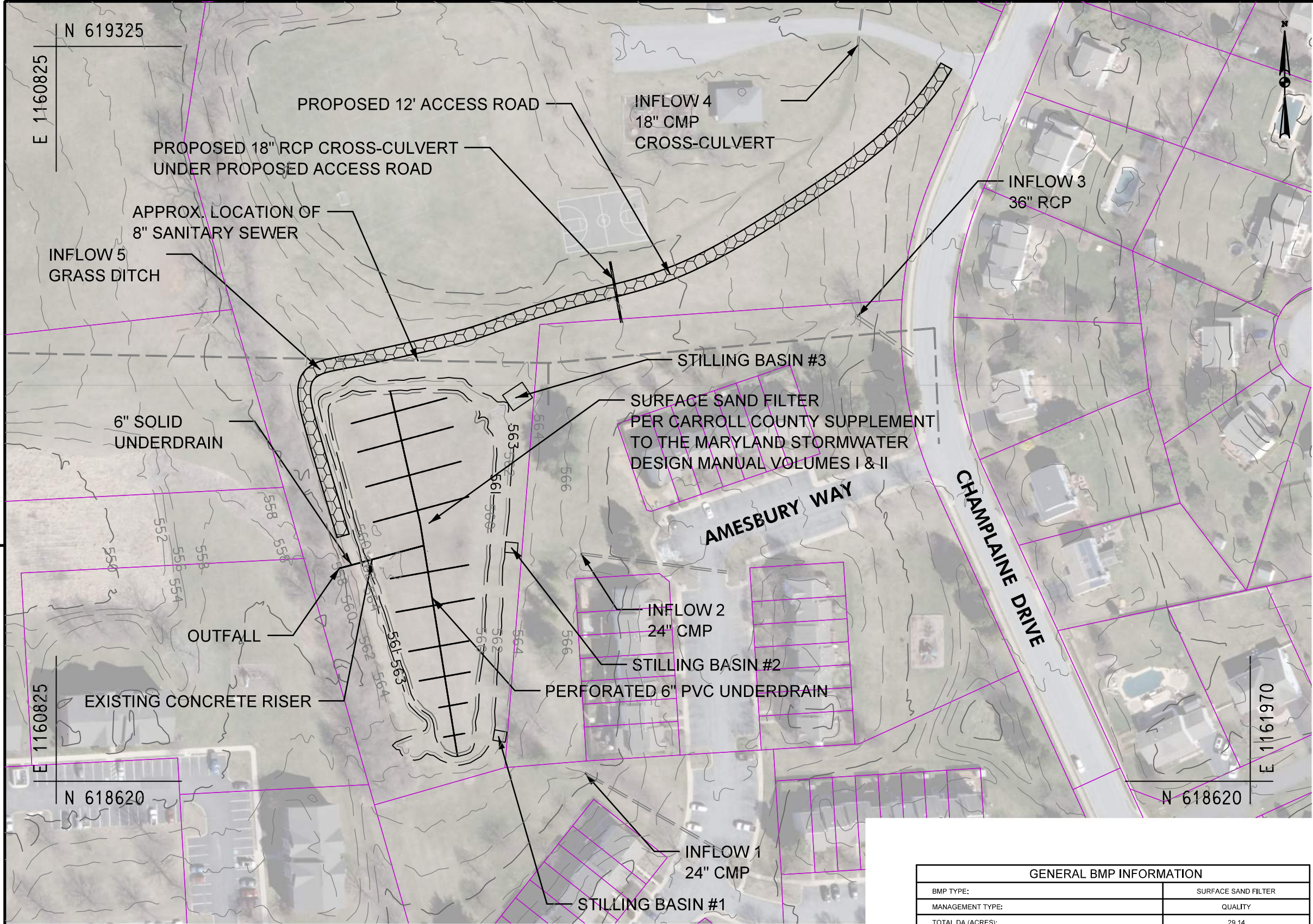
Photo 1: Overall facility looking north



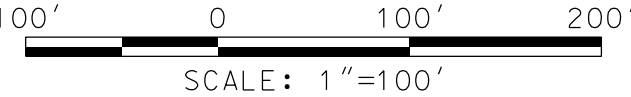
Photo 2: Ponding downstream of twin 42" BCCMPs looking southeast




Photo 3: Downstream channel looking west




- NOTE:
1. SURFACE SAND FILTER DESIGNED PER CARROLL COUNTY SUPPLEMENT TO THE MARYLAND STORMWATER DESIGN MANUAL VOLUMES I & II.
 2. THE EXISTING FACILITY BOTTOM MAY NEED TO BE RAISED IN ORDER TO OUTFALL THE FACILITY AND SHOULD BE EVALUATED DURING FINAL DESIGN.
 3. FACILITY SIZE AND EMBANKMENT HEIGHT SHOULD BE EVALUATED DURING FINAL DESIGN TO DETERMINE QUANTITY STORAGE.
 4. REMOVAL OF THE EXISTING RISER SHOULD BE EVALUATED DURING FINAL DESIGN.
 5. INFLOW PIPE SIZES SHOULD BE FIELD VERIFIED PRIOR TO FINAL DESIGN.
 6. ONLY TWO-FOOT CONTOURS WERE AVAILABLE VIA GIS. ANY EXISTING ONE-FOOT CONTOURS WERE DIGITIZED BY OFFSETTING FROM THE TWO-FOOT CONTOURS.




GENERAL BMP INFORMATION	
BMP TYPE:	SURFACE SAND FILTER
MANAGEMENT TYPE:	QUALITY
TOTAL DA (ACRES):	29.14
TOTAL IMPERVIOUS AREA (ACRES):	7.53
WQv REQUIRED (CU. FT):	29889.19
WQv REQUIRED (AC. FT):	0.69
WATER QUALITY TREATMENT PROVIDED	
WQv PROVIDED (CU. FT):	143210.77
TOTAL TREATED DA (ACRES):	29.14
MINIMUM IMPERVIOUS AREA TREATMENT PROVIDED (ACRES):	7.53

		Catoclin Creek Watershed Assessment Frederick County Office of Sustainability and Environmental Resources Frederick, MD 21701	
BMP #29			
SCALE 1" = 100'		ADVERTISED DATE _____ CONTRACT NO. _____	
DESIGNED BY _____	VH	COUNTY _____	Frederick, MD
DRAWN BY _____	VH	LOGMILE _____	
CHECKED BY _____	MJ	HORIZONTAL SCALE _____	
		VERTICAL SCALE _____	
DRAWING NO. _____		OF _____	SHEET NO. _____ OF _____




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LEGEND



PARCEL BOUNDARY



400EXISTING GIS CONTOURS



400EXISTING DIGITIZED CONTOURS

BY: vhamsher -

Project: **BMP 29** Surface Sand Filter
Preliminary Design: per Carroll County Supplement to the Maryland
Stormwater Design Manual Volumes I & II

Location: **Frederick County, Maryland**

Watershed: **Catoctin Creek**

Stream Use:

Site Area: **29.14** ac **0.0455313** sqm

Measured Impervious Area: **7.53** ac

$I = \frac{0.258}{25.84} =$ %

Soil Type: **B**

RCN Post Development : **78** $tc =$ **0.4** hr Per Frederick County's NPDES Database

Step 1: WQv Value

$$WQ_v = \frac{(P)(R_v)(A)}{12}$$

Step 1(a): Compute volumetric Runoff Coefficient(Rv)

$$R_v = 0.05 + (0.009)I =$$
 0.283

Step 1(b): Rainfall Zone

Rainfall Zone: Western Rainfall zone with Rainfall (P)= **1** inch

Per MDE's Accounting Guidance, Accounting of Stormwater Wasteload Allocations, and Impervious Acres Treated (2014)

Step 1(c): Compute WQv

Water quality required for I = **26%**

$$WQ_{v(I)} =$$
 0.686 ac-ft = **29889** cft

Minimum water quality required 0.2 inches per acre of the drainage area,

$$WQ_{v(\text{Min})} =$$
 0.486 ac-ft = **21155.64** cft

$$\text{Water quality treatment required} =$$
 29889.187 cft = **0.6862** ac-ft

Step 1(d): Water Quality Discharge

a. Runoff Volume = $Q_a = P \cdot R_v =$ **0.2825669** in

b. CN for W_Q storm = **88.93** (from page D.10.1
2000 MDE Stormwater Management Manual)

c. Initial Abstraction = $I_a = (200/CN) - 2 =$ **0.25**

d. $I_a/P =$ **0.25**

e. Unit Peak Discharge = $q_u =$ **537** csm/in (Figure D.11.1)

f. Water Quality Peak Flow = $Q_w = (q_u \text{ csm/in}) \cdot (A \text{ mi}^2) \cdot (q_a \text{ in}) =$ **6.90** cfs

Step 2: Pretreatment Volume

Step 2(a) Stilling Basin Dimensions

from Carroll County Supplement to the Maryland
Stormwater Design Manual Volumes I & II

STILLING BASIN DIMENSIONS					
LEGEND					
PIPE DIA. (IN.)	"A" (FT.)	"B" (FT.)	"C" (FT.)	"D" (FT.)	"E" (FT.)
15"	5.64	2.50	7.50	6.28	0.63
18"	6.75	3.00	9.00	7.50	0.75
21"	7.89	3.50	10.50	8.78	0.88
24"	9.00	4.00	12.00	10.00	1.00
27"	10.14	4.50	13.50	11.28	1.13
30"	11.25	5.00	15.00	12.50	1.25
36"	13.50	6.00	18.00	15.00	1.50
42"	15.00	7.00	19.50	16.00	1.50
48"	16.50	8.00	21.00	17.00	1.50
54"	18.00	9.00	22.50	18.00	1.50
60"	19.50	10.00	24.00	19.00	1.50
72"	22.50	12.00	27.00	21.00	1.50
84"	25.50	14.00	30.00	23.00	1.50
96"	28.50	16.00	33.00	25.00	1.50
108"	31.50	18.00	36.00	27.00	1.50
120"	34.50	20.00	39.00	29.00	1.50

NOTES: DEPTH OF STILLING BASIN IS $\frac{1}{2}$ PIPE DIAMETER UP TO THICKNESS OF FILTER LAYER. THIS TABLE IS BASED ON A 18" LAYER.

Stilling Basin #1:

Inflow #1 - 24" CMP

Stilling Basin #2:

Inflow #2 - 24" CMP

Stilling Basin #3:

Inflow #4 - 18" CMP

Inflow #3 - 30" RCP

Step 3: Treatment

Step 3(a) Compute Storage Volume prior to Filtration: (100% of WQ_v)

$$V_{\text{temp}} = 29889.19 \text{ cft}$$

Step 3(b) Compute the Required Filter Bed Area: (A_f)

$$A_f = \frac{(WQ_v)(d_f)}{[k \times (h_f + d_f) \times t_f]}$$

Minimum Filter Bed Depth = 12"

$$\begin{aligned} \text{Design Filter Bed Depth (d}_f\text{)} &= 40 \text{ "} \\ &= 3.33 \text{ ft} \end{aligned}$$

Filter Media: SHA Bioretention Soil Mix
Coefficient of Permeability (k) = 2 ft/day

Filter Bed Drain Time (t_f) = 1.67 days

Design Temporary Ponding Height above the Filter Bed (t_p) = 2 ft

Design Average Height of Water above the Filter Bed (h_f) = 1 ft

$$A_f = 6883.74 \text{ sft}$$

Step 3(c) Design the Filter Chamber

Setting Width = 120 ft 1

Required Length = 57.4 ft

Design Length = 355 ft

Use a Filter Chamber 120 ft by 355 ft

Stage - Storage Data for Sand Filter								
Stage	Elevation	Area	Average Area	Incr. Storage	Total Storage		Storage Above Dead Storage	
(ft)	(ft)	(sft)	(sft)	(cft)	(cft)	(ac-ft)	(ac-ft)	(cft)
0.00	561.33	36996.48			0.0	0.0000	0.0000	0.00
			40630.30	40630.3				
1.00	562.33	44264.12			40630.3	0.9327	0.9327	40630.13
			45780.82	45780.8				
2.00	563.33	47297.52			86411.1	1.9837	1.9837	86410.77

$$V_{\text{treatment}} = (t_p \times l \times b) + (d_f \times l \times b \times 0.4)$$

$$= 143210.77 \text{ cft}$$

Step 4: Check

$V_{\text{total}} =$ 143210.77 cft

Required $V_{\text{total}} =$ 29889.19 cft

Design Criteria Satisfaction: Yes

Step 5: Compute Recharge Volume (Rev)

Step 5(a) : Determine Soil Specific Recharge Factor (S) Based on Hydrologic Soil Group

HSG	Soil Specific Recharge Factor (s)	
A	0.38	
B	0.26	
C	0.13	
D	0.07	
HSG	Drainage Area (ac)	Percentage (%)
A	0.00	0
B	29.14	100
C	0.00	0
D	0	0
Total	29.14	OK: sum of the areas must equal 100

$$Re \ v = \frac{(S)(Rv)(A)}{12}$$

OK: sum of the areas matches site Area

Composite S: 0.2600 Use 26.00 of site imperviousness

Step 5(b): Compute Rev Using Percent Volume Method

Rev = [(S)(Rv)(A)]/12 = 0.178 ac-ft = 7771 cft

Step 5(c): Compute Rev Using Percent Area Method

Rev = (S)(Ai) = 1.958 ac = 85281 sf

Recharge volume is included in the water quality volume.

The Rev requirement may be met by a) treating 0.178 ac-ft using structural method, b) treating 1.958 acres using non-structural methods, or c) a combination of both or it is part of WQv volume if not treated separately.

Storm Water Management Retrofit Evaluation					
Report Date:	3/22/2019	Design Approval:	11/14/1990	Maintenance Owner:	Briercrest Associates LLC
Structure No (NPDES Number):	115	As-Built Date:*	2/5/1997	Inspection Date:	5/1/2018
Structure Name:	Briercrest Apartments	NPDES Watershed:	Catoctin Creek	Inspection Team:	MV, JS
Location:	East and North of Shadywood Drive	MDE 8 Digit Name/#:	Catoctin Creek (2140305)	Last Significant Rainfall:	4/27/2018 (0.39")
Northing/Easting:	618922.99/1160665.00	Land-River Segment:	B24021PM1_4000_4290	Rainfall Source:	www.wunderground.com
		Stream Use:	IP	Station:	KMDJEFFE3
BMP Description					
	Existing Condition		Proposed Condition		
General BMP Information					
BMP Type:	Extended Detention Dry Pond		Surface Sand Filter		
BMP Classification:	N/A		Stormwater Treatment (ST) Practice		
Management Type:	Quantity/Quality		Quality		
Total Drainage Area (acres):	45.7		37.6		
Total Impervious Area within Drainage Area (acres):	Unknown		10		
WQv Required:	Unknown		39494.09 cu.ft.	0.91 ac.ft.	
Does Facility Meet MDE 2000 WQv Requirements (Y/N):	No		Yes		
Adequate ROW (Y/N):	Yes		Yes		
Adequate Access (Y/N):	No		Yes		
Estimated Treatment Provided		Per Design	Per MDE 2000 Standards		
WQv Provided:		Unknown	0	112249.12 cu.ft.	2.58 ac.ft.
Total Treated Drainage Area (acres):		45.7	0	37.6	
Minimum Impervious Area Treatment Provided (ac):		Unknown	0	10	
Estimated Pollutant Removal Rates					
Minimum Runoff Volume Treated per Impervious Acre (in.)				1.00	
Total Nitrogen:				34.95%	
Total Phosphorus:				54.92%	
Sediment:				69.90%	
Estimated Pollutant Load Reduction				Edge of Stream (EOS)	Edge of Tide (EOT)
TN (lbs/yr):		0		24.81	19.04
TP (lbs/yr):		0		4.99	3.27
TSS (lbs/yr):		0		4668.21	2538.90
Projected Retrofit Cost:					\$749,700.00

*As-Built Date from the NPDES Database does not match the as-built date shown on the as-built plans.

SITE ID: BMP #115

Prioritization Ranking: 10

Planning/Construction Level Cost Estimate: \$749,700.00

Estimated Cost/Impervious Acre: \$74,970.00

General BMP Information		
Structure Location:	East and North of Shadywood Drive	
NPDES Number:	115	
Northing/Easting:	618922.99/1160665.00	
NPDES Watershed:	Catoctin Creek	
MDE 8 Digit Watershed:	Catoctin Creek (2140305)	
Proposed BMP Retrofit General Information		
Proposed BMP Type:	Surface Sand Filter	
Management Type:	Quality	
Total Drainage Area (ac):	37.60	
Total Impervious Area (ac):	10.00	
Water Quality Treatment Provided:		
WQv Provided (cu.ft.):	112249.12	
Total Treated Drainage Area (ac):	37.60	
Minimum Impervious Area Treatment Provided (ac):	10.00	
Estimated Nutrient Reductions*:	EOS	EOT
TN (lbs/yr):	24.81	19.04
TP (lbs/yr):	4.99	3.27
TSS (lbs/yr):	4668.21	2538.90



BMP #115

Required Permitting

Frederick County SWM Review	X
Erosion and Sediment Control (ESC):	X
Grading Permit:	X
Joint Permit Application (JPA)/General Waterway Construction Permit:	
Construction NOI:	X
Other:	

**Estimated Nutrient Reductions exclude the nested drainage area and impervious area from BMP #29 in order to avoid double counting estimated nutrient reductions.*

EXISTING SITE CONDITIONS

BMP #115 is an existing extended detention dry pond (Photo 1) with a 21'-6" concrete weir with a 3" low flow orifice. A 36" CMP conveys flow underneath Shadywood Drive (Photo 2) and outfalls into a ditch on the west side of Shadywood Drive (Photo 3). There are four (4) exiting inflows and one (1) proposed inflow to this facility. Inflow #1 is an existing riprap ditch which conveys flow from the twin 42" BCCMP outfall of BMP #29. The riprap ditch enters the facility in the northeast corner. Inflow #2 is an existing dual 15" CMP entering the facility in the southwest corner. Inflow #3 is a 15" CMP entering the facility along the south side. Inflow #4 is the 15" CMP entering the facility in the southeast corner. There is an 8" sanitary sewer that runs perpendicular to Shadywood Drive north of the facility. There are no overhead utilities present at the site or along the proposed access road. The surrounding land use is high-density residential and open urban land.

PROPOSED RETROFIT

The proposed facility type for BMP #115 is an enhanced surface sand filter designed per *Carroll County Supplement to the Maryland Stormwater Design Manual Volumes I & II*. The proposed facility will provide quality management for 37.60 acres including a minimum impervious area treatment of 10.00 acres. The proposed facility will be constructed within the existing facility footprint. A forebay is proposed to capture flows from Inflow #1, Inflow #2, Inflow #3 and Inflow #4 since combined, it will capture more than 10 acres of impervious area. The existing facility bottom may need to be raised in order to outfall the facility and should be evaluated during final design. Per our analysis of available design plans and GIS contours, the existing 36" CMP conveys flow underneath Shadywood Drive at an approximate elevation of 548'. The approximate depth required to outfall the underdrain for the proposed facility is 3.33' per *Carroll County Supplement to the Maryland Stormwater Design Manual Volumes I & II*. As such, the raised facility bottom would need to be at 551.33'. This elevation and an assumed depth of 2' for quality storage was used to determine quality sizing in our computations. The facility size, embankment height and control structure elevation will need to be evaluated during final design to determine quantity storage. The site can be accessed via Shadywood Drive.

ANTICIPATED SITE CONSTRAINTS

There is an 8" sanitary sewer that runs perpendicular to Shadywood Drive north of the facility.



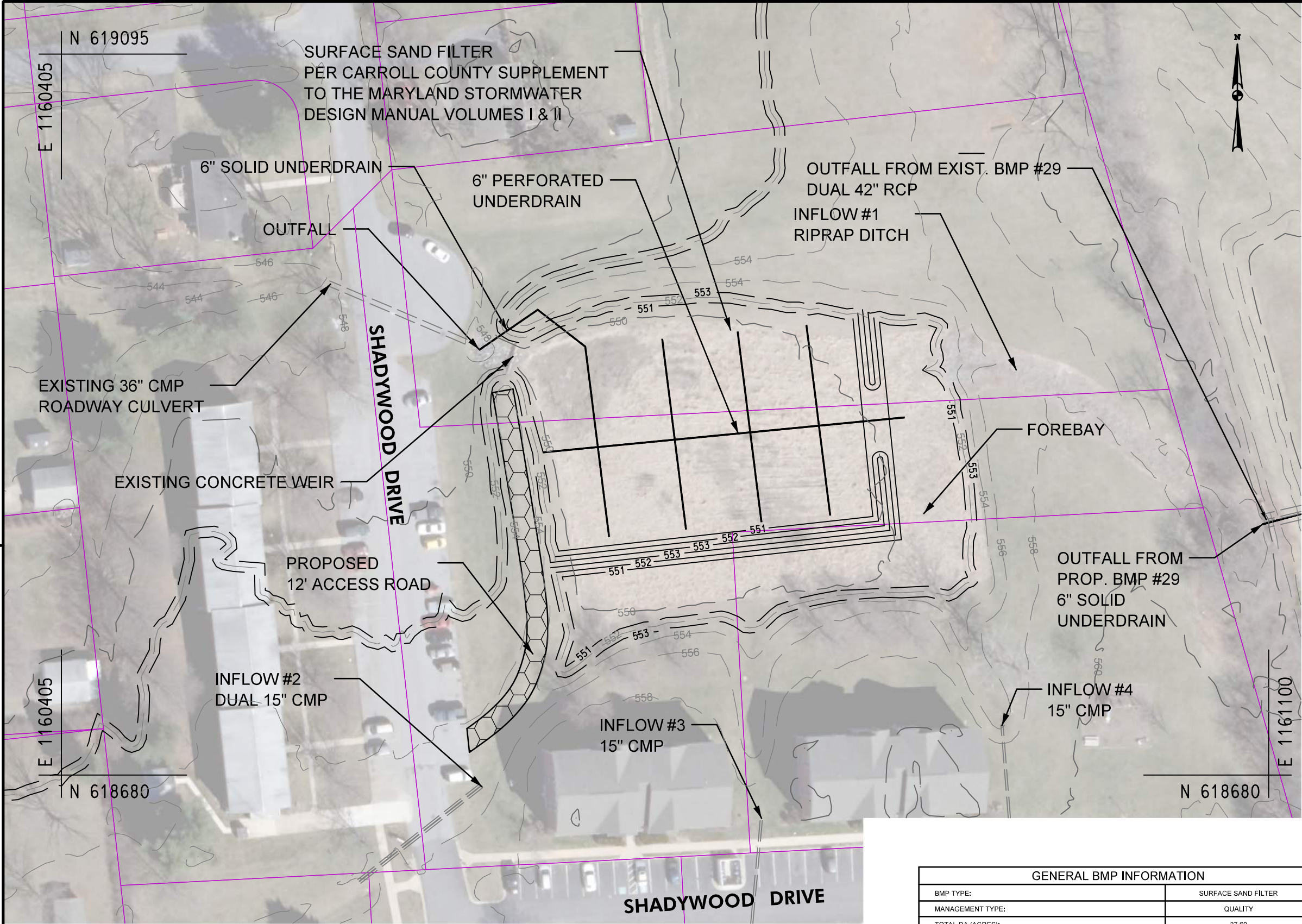
Photo 1: Overall facility looking west



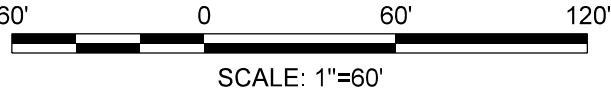
Photo 2: 36" CMP cross-culvert under Shadywood Drive looking northwest




Photo 3: Downstream channel looking southeast



NOTE:
1. SURFACE SAND FILTER DESIGNED PER CARROLL COUNTY SUPPLEMENT TO THE MARYLAND STORMWATER DESIGN MANUAL VOLUMES I & II.
2. THE EXISTING FACILITY BOTTOM MAY NEED TO BE RAISED IN ORDER TO OUTFALL THE FACILITY AND SHOULD BE EVALUATED DURING FINAL DESIGN.
3. FACILITY SIZE, EMBANKMENT HEIGHT AND CONTROL STRUCTURE SHOULD BE EVALUATED DURING FINAL DESIGN TO DETERMINE QUANTITY STORAGE.
4. ONLY TWO-FOOT CONTOURS WERE AVAILABLE VIA GIS. ANY EXISTING ONE-FOOT CONTOURS WERE DIGITIZED BY OFFSETTING FROM THE TWO-FOOT CONTOURS.



GENERAL BMP INFORMATION	
BMP TYPE:	SURFACE SAND FILTER
MANAGEMENT TYPE:	QUALITY
TOTAL DA (ACRES):	37.60
TOTAL IMPERVIOUS AREA (ACRES):	10.00
WQv REQUIRED (CU, FT):	39494.09
WQv REQUIRED (AC, FT):	0.91
WATER QUALITY TREATMENT PROVIDED	
WQv PROVIDED (CU, FT):	112249.12
TOTAL TREATED DA (ACRES):	37.60
MINIMUM IMPERVIOUS AREA TREATMENT PROVIDED (ACRES):	10.00




Catoclin Creek Watershed Assessment
Frederick County Office of Sustainability
and Environmental Resources
Frederick, MD 21701

BMP #115

SCALE: 1"=60' ADVERTISED DATE: CONTRACT NO.:





DESIGNED BY: VH COUNTY: Frederick, MD
DRAWN BY: VH LOGMILE:
CHECKED BY: MJ HORIZONTAL SCALE:
VERTICAL SCALE:

DRAWING NO. OF SHEET NO. OF



Dewberry®
Dewberry Engineers
10461 MILL RUN CIRCLE
SUITE #300
OWINGS MILLS, MARYLAND 21117
PHONE: 410.265.9500
FAX: 410.265.8875

LEGEND

 PARCEL BOUNDARY
 EXISTING GIS CONTOURS
 EXISTING DIGITIZED CONTOURS
 PROPOSED CONTOURS

BY: vhamsher -

Project: **BMP 115** Surface Sand Filter
Preliminary Design: per Carroll County Supplement to the Maryland Stormwater Design Manual Volumes I & II

Location: **Frederick County, Maryland**

Watershed: **Catoctin Creek** Stream Use:

Site Area: **37.6** ac **0.05875** sqm

Measured Impervious Area: **10** ac
 $I = \frac{0.266}{26.60} =$ %

Soil Type: **B, C, D**

RCN Post Development : **78** $tc =$ **0.4** hr Per Frederick County's NPDES Database

Step 1: WQ_v Value

$$WQ_v = \frac{(P)(R_v)(A)}{12}$$

Step 1(a): Compute volumetric Runoff Coefficient(R_v)

$$R_v = 0.05 + (0.009)I = 0.289$$

Step 1(b): Rainfall Zone

Rainfall Zone: Western Rainfall zone with Rainfall (P)= **1** inch

Per MDE's Accounting Guidance, Accounting of Stormwater Wasteload Allocations, and Impervious Acres Treated (2014)

Step 1(c): Compute WQ_v

Water quality required for I = **27%**

$$WQ_{v(I)} = 0.907 \text{ ac-ft} = 39494 \text{ cft}$$

Minimum water quality required 0.2 inches per acre of the drainage area,

$$WQ_{v(\text{Min})} = 0.627 \text{ ac-ft} = 27297.6 \text{ cft}$$

$$\text{Water quality treatment required} = 39494.092 \text{ cft} = 0.9067 \text{ ac-ft}$$

Step 1(d): Water Quality Discharge

a. Runoff Volume = $Q_a = P \cdot R_v = 0.289362$ in

b. CN for W_Q storm = **89.13** (from page D.10.1
2000 MDE Stormwater Management Manual)

c. Initial Abstraction = $I_a = (200/CN) - 2 = 0.24$

d. $I_a/P = 0.24$

e. Unit Peak Discharge = $q_u = 540$ csm/in (Figure D.11.1)

f. Water Quality Peak Flow = $Q_w = (q_u \text{ csm/in}) \cdot (A \text{ mi}^2) \cdot (q_a \text{ in}) = 9.18$ cfs

Step 2: Pretreatment Volume

$$\left(A_s = \frac{Q_o}{W} \times E' \right)$$

Step 2(a) Compute Pretreatment Volume: (25% of WQ_v)

$$\text{Minimum Required } V_p = 9873.52 \text{ cft}$$

Step 2(b) Compute Sedimentation Basin Minimum Surface Area: (A_{sf})

$$A_{sf} = (0.066)(WQ_v), \text{ if } I \leq 75\% \\ = 2606.61 \text{ sft}$$

Step 2(c) Design the Sedimentation Basin

Design Width (w) = 30 ft
 Design Length (l) = 348 ft

Suggested Length to Width Ratio = 2:1

Required Depth = 0.9 ft
 Design Depth (d) = 2 ft

Maximum Depth = 2'

Stage - Storage Data for Forebay						
Stage (ft)	Elevation (ft)	Area (sft)	Avg Area (sft)	Incr. (cft)	Storage (cft)	(ac-ft)
0.00	551.33	11312.71			0.0	0
			12533.61	12533.6		
1.00	552.33	13754.51			12533.6	0.28773
			15020.28	15020.3		
2.00	553.33	16286.05			27553.9	0.63255

Use a Sedimentation Chamber 30 ft by 348 ft by 2 ft = 27553.9 cft
 (with side slopes of 3:1)

Provided Vp = 27553.9 cft

Step 3: Treatment

Step 3(a) Compute Storage Volume prior to Filtration (including Pretreatment): (75% of WQ_v)

$V_{temp} = 29620.57$ cft

Step 3(b) Compute the Required Filter Bed Area: (A_f)

$$A_f = \frac{(WQ_v)(d_f)}{[k \times (h_f + d_f) \times t_f]}$$

Minimum Filter Bed Depth = 12"

Design Filter Bed Depth (d_f) = 40 "
 = 3.33 ft

Filter Media: SHA Bioretention Soil Mix
 Coefficient of Permeability (k) = 2 ft/day

Filter Bed Drain Time (t_f) = 1.67 days

Design Temporary Ponding Height above the Filter Bed (t_p) = 2 ft

Design Average Height of Water above the Filter Bed (h_f) = 1 ft

$A_f = 9095.83$ sft

Step 3(c) Design the Filter Chamber

Setting Width = 134 ft

Required Length = 67.9 ft

Design Length = 185

Use a Filter Chamber 134 ft by 185 ft

Stage - Storage Data for Sand Filter								
Stage	Elevation	Area	Average Area	Incr. Storage	Total Storage		Storage Above Dead Storage	
(ft)	(ft)	(sft)	(sft)	(cft)	(cft)	(ac-ft)	(ac-ft)	(cft)
0.00	551.33	23928.59			0.0	0.0000	0.0000	0.00
			24865.97	24866.0				
1.00	552.33	25803.35			24866.0	0.5708	0.5708	24865.87
			26776.13	26776.1				
2.00	553.33	27748.91			51642.1	1.1855	1.1855	51641.89

$$V_{\text{treatment}} = (t_p \times l \times b) + (d_f \times l \times b \times 0.4)$$

$$= 84695.22496 \text{ cft}$$

Step 4: Check

$V_{\text{total}} = V_p + V_{\text{treatment}} = 112249.12 \text{ cft}$

Required Vtotal = 39494.09 cft

Design Criteria Satisfaction: Yes

Step 5: Compute Recharge Volume (Rev)

Step 5(a) : Determine Soil Specific Recharge Factor (S) Based on Hydrologic Soil Group

HSG	Soil Specific Recharge Factor (s)	
A	0.38	
B	0.26	
C	0.13	
D	0.07	
HSG	Drainage Area (ac)	Percentage (%)
A	0.00	0
B	24.89	66
C	10.55	28
D	2.19	6
Total	37.63	OK: sum of the areas

$$Re \ v = \frac{(S)(Rv)(A)}{12}$$

Composite S: 0.2125 Use 21.25 of site imperviousness

Step 5(b): Compute Rev Using Percent Volume Method

Rev = [(S)(Rv)(A)]/12 = 0.193 ac-ft = 8392 cft

Step 5(c): Compute Rev Using Percent Area Method

Rev = (S)(Ai) = 2.125 ac = 92562 sf

Recharge volume is included in the water quality volume.

The Rev requirement may be met by a) treating 0.193 ac-ft using structural method, b) treating 2.125 acres using non-structural methods, or c) a combination of both or it is part of WQv volume if not treated separately.

Storm Water Management Retrofit Evaluation					
Report Date:	3/22/2019	Design Approval:	4/11/1996	Maintenance Owner:	Mr. Robert White
Structure No (NPDES Number):	672	As-Built Date:	5/14/2004	Inspection Date:	5/1/2018
Structure Name:	Jefferson Court, Section 2 - WQ Pond	NPDES Watershed:	Catoctin Creek	Inspection Team:	MV, JS
		MDE 8 Digit Name/#:	Catoctin Creek (2140305)	Last Significant Rainfall:	4/27/2018 (0.39")
Location:	Southview Court cul-de-sac	Land-River Segment:	B24021PM1_4000_4290	Rainfall Source:	www.wunderground.com
Northing/Easting:	616964.89/1160862.49	Stream Use:	1P	Station:	KMDJEFFE3
BMP Description					
	Existing Condition		Proposed Condition		
General BMP Information					
BMP Type:	Extended Detention Dry Pond		Surface Sand Filter		
BMP Classification:	N/A		Stormwater Treatment (ST) Practice		
Management Type:	Quantity/Quality		Quality		
Total Drainage Area (acres):	9.1		10.12		
Total Impervious Area within Drainage Area (acres):	Unknown		3.15		
WQv Required:	Unknown		12127.74 cu.ft.	0.28 ac.ft.	
Does Facility Meet MDE 2000 WQv Requirements (Y/N):	No		Yes		
Adequate ROW (Y/N):	Yes		Yes		
Adequate Access (Y/N):	No		Yes		
Estimated Treatment Provided		Per Design	Per MDE 2000 Standards		
WQv Provided:		Unknown	0	79248.57 cu.ft.	1.82 ac.ft.
Total Treated Drainage Area (acres):		9.1	0	10.12	
Minimum Impervious Area Treatment Provided (ac):		Unknown	0	3.15	
Estimated Pollutant Removal Rates					
Minimum Runoff Volume Treated per Impervious Acre (in.)			1.00		
Total Nitrogen:	N/A		34.95%		
Total Phosphorus:			54.92%		
Sediment:			69.90%		
Estimated Pollutant Load Reduction			Edge of Stream (EOS)	Edge of Tide (EOT)	
TN (lbs/yr):		0	30.67	23.52	
TP (lbs/yr):		0	5.81	3.81	
TSS (lbs/yr):		0	5924.40	3222.11	
Projected Retrofit Cost:					\$236,155.50

SITE ID: BMP #672

Prioritization Ranking: 11

Planning/Construction Level Cost Estimate: \$236,155.50

Estimated Cost/Impervious Acre: \$74,970.00

General BMP Information		
Structure Location:	Southview Court cul-de-sac	
NPDES Number:	672	
Northing/Easting:	616964.89/1160862.49	
NPDES Watershed:	Catoctin Creek	
MDE 8 Digit Watershed:	Catoctin Creek (2140305)	
Proposed BMP Retrofit General Information		
Proposed BMP Type:	Surface Sand Filter	
Management Type:	Quality	
Total Drainage Area (ac):	10.12	
Total Impervious Area (ac):	3.15	
Water Quality Treatment Provided:		
WQv Provided (cu.ft.):	79248.57	
Total Treated Drainage Area (ac):	10.12	
Minimum Impervious Area Treatment Provided (ac):	3.15	
Estimated Nutrient Reductions:	EOS	EOT
TN (lbs/yr):	30.67	23.52
TP (lbs/yr):	5.81	3.81
TSS (lbs/yr):	5924.40	3222.11



BMP #672

Required Permitting

Frederick County SWM Review	X
Erosion and Sediment Control (ESC):	X
Grading Permit:	X
Joint Permit Application (JPA)/General Waterway Construction Permit:	
Construction NOI:	
Other:	

EXISTING SITE CONDITIONS

BMP #672 is an existing extended detention dry pond (Photo 1) with an 8" perforated PVC dewatering device (Photo 2). There is no stone around the control structure as specified in the design plans and both PVC caps are missing. The geotextile fabric around the control structure was not removed post construction when the facility was converted from an erosion and sediment control device. Minor erosion is present below the 8" PVC outfall (Photo 3). The facility outfalls to the southeast via a grass ditch (Photo 4). There is one (1) inflow to this facility. Inflow #1 is 30" RCP entering the facility in the northwest corner. There are two (2) 25' spillways located along the east side and south side of the facility. There are no overhead utilities present at the site or along the proposed access road. The surrounding land use is medium-density residential.

PROPOSED RETROFIT

The proposed facility type for BMP #672 is an enhanced surface sand filter designed per *Carroll County Supplement to the Maryland Stormwater Design Manual Volumes I & II* which will provide quality management for 10.12 acres including a minimum impervious area treatment of 3.15 acres. The proposed facility will be constructed within the existing facility footprint. One stilling basin is proposed and is to be placed downstream of Inflow #1. Stilling basin size is

determined using the size of the inflow pipe. The stilling basin location and size, in conjunction with the inflow pipe, should be evaluated during final design to ensure positive drainage from the inflow pipe into the facility. The existing facility bottom may need to be raised in order to outfall the facility and should be evaluated during final design. Per our analysis of available design plans and GIS contours, the current principal spillway outfalls at an approximate elevation of 550'. The approximate depth required to outfall the underdrain for the proposed facility is 3.33' per *Carroll County Supplement to the Maryland Stormwater Design Manual Volumes I & II*. As such, the raised facility bottom would need to be at 553.33'. This elevation and an assumed depth of 2' for quality storage was used to determine quality sizing in our computations. The facility size and embankment height will need to be evaluated during final design to determine quantity storage. Removal of the existing dewatering and SWM water quality device should be evaluated during final design. The site can be accessed via Southview Court.

ANTICIPATED SITE CONSTRAINTS

There are no anticipated site constraints.



Photo 1: Overall facility looking southeast



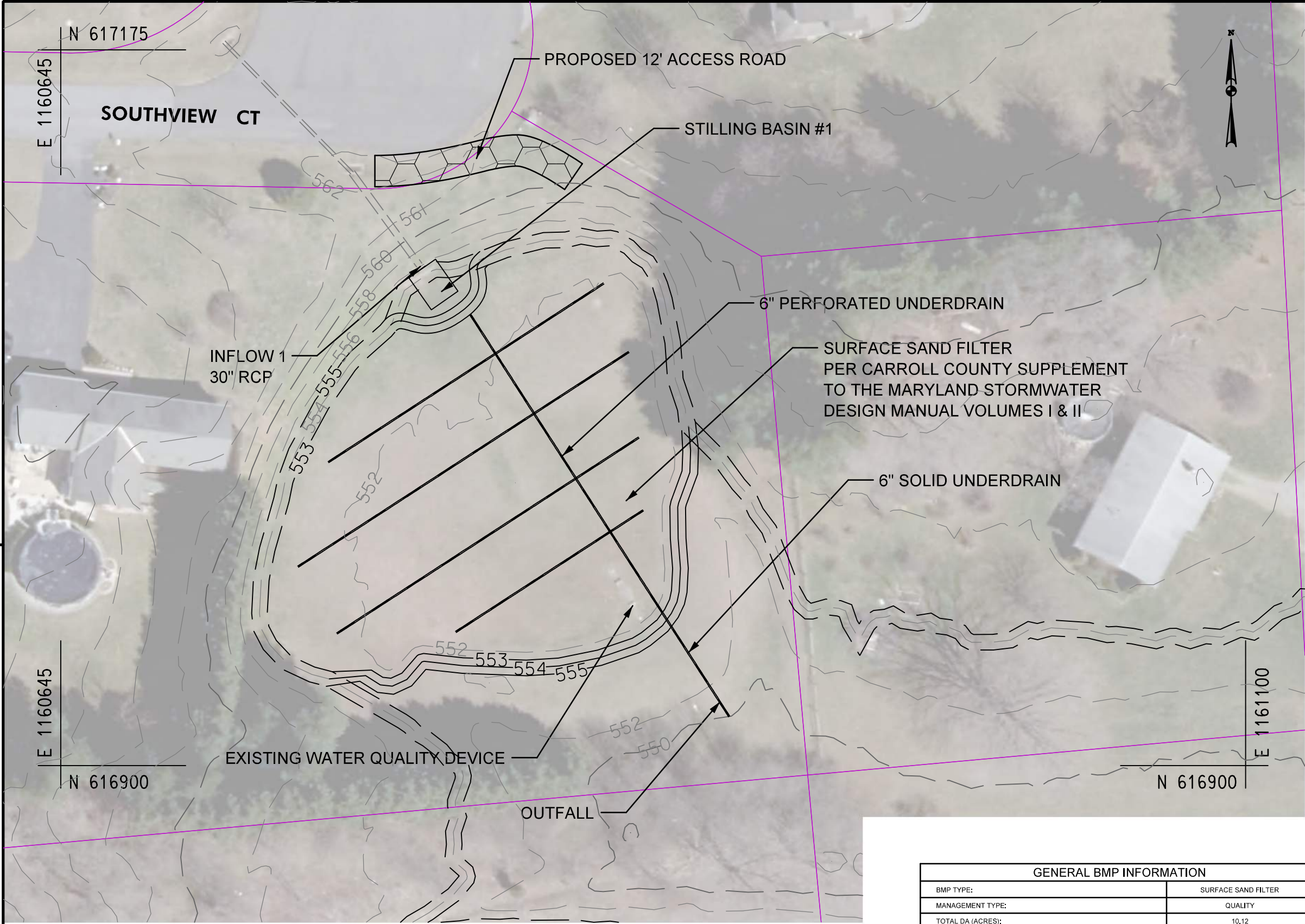
Photo 2: Control structure looking southeast



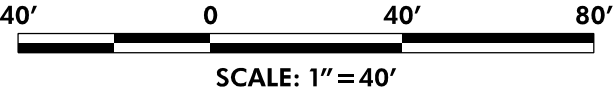
Photo 3: Downstream control structure looking northwest




Photo 4: Downstream grass channel looking southeast




- NOTE:
1. SURFACE SAND FILTER DESIGNED PER CARROLL COUNTY SUPPLEMENT TO THE MARYLAND STORMWATER DESIGN MANUAL VOLUMES I & II.
 2. THE EXISTING FACILITY BOTTOM MAY NEED TO BE RAISED IN ORDER TO OUTFALL THE FACILITY AND SHOULD BE EVALUATED DURING FINAL DESIGN.
 3. FACILITY SIZE AND EMBANKMENT HEIGHT SHOULD BE EVALUATED DURING FINAL DESIGN TO DETERMINE QUANTITY STORAGE.
 4. REMOVAL OF THE EXISTING DEWATERING AND SWM WATER QUALITY DEVICE SHOULD BE EVALUATED DURING FINAL DESIGN.
 5. STILLING BASIN LOCATION AND ELEVATIONS SHOULD BE EVALUATED, IN CONJUNCTION WITH THE INFLOW PIPE, DURING FINAL DESIGN TO ENSURE POSITIVE DRAINAGE FROM THE INFLOW PIPE AND POSITIVE DRAINAGE INTO THE FACILITY.
 6. ONLY TWO-FOOT CONTOURS WERE AVAILABLE VIA GIS. ANY EXISTING ONE-FOOT CONTOURS WERE DIGITIZED BY OFFSETTING FROM THE TWO-FOOT CONTOURS.



GENERAL BMP INFORMATION	
BMP TYPE:	SURFACE SAND FILTER
MANAGEMENT TYPE:	QUALITY
TOTAL DA (ACRES):	10.12
TOTAL IMPERVIOUS AREA (ACRES):	3.15
WQv REQUIRED (CU. FT):	12127.74
WQv REQUIRED (AC. FT):	0.28
WATER QUALITY TREATMENT PROVIDED	
WQv PROVIDED (CU. FT):	79248.57
TOTAL TREATED DA (ACRES):	10.12
MINIMUM IMPERVIOUS AREA TREATMENT PROVIDED (ACRES):	3.15

		Catoclin Creek Watershed Assessment Frederick County Office of Sustainability and Environmental Resources Frederick, MD 21701	
BMP #672			
SCALE: 1" = 40'		ADVERTISED DATE: _____ CONTRACT NO.: _____	
DESIGNED BY: _____	VH	COUNTY: _____	Frederick, MD
DRAWN BY: _____	VH	LOGMILE: _____	
CHECKED BY: _____	MJ	HORIZONTAL SCALE: _____	
		VERTICAL SCALE: _____	
DRAWING NO. _____		OF _____	SHEET NO. _____ OF _____



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FAX: 410.265.8875

LEGEND

PARCEL BOUNDARY

400EXISTING GIS CONTOURS

400EXISTING DIGITIZED CONTOURS

400PROPOSED CONTOURS

Project: **BMP 672** Surface Sand Filter
per Carroll County Supplement to the Maryland
Stormwater Design Manual Volumes I & II

Preliminary Design:

Location: **Frederick County, Maryland**

Watershed: **Catoctin Creek**

Stream Use:

Site Area: **10.12** ac **0.0158125** sqm

Measured Impervious Area:

$$I = \frac{3.15}{31.13} = 0.311 \text{ ac}$$

Soil Type: **B**

RCN Post Development : **76** **tc = 0.28** hr Per Frederick County's NPDES Database

Step 1: WQv Value

$$WQ_v = \frac{(P)(R_v)(A)}{12}$$

Step 1(a): Compute volumetric Runoff Coefficient(Rv)

$$R_v = 0.05 + (0.009)I = 0.330$$

Step 1(b): Rainfall Zone

Rainfall Zone: Western Rainfall zone with Rainfall (P)= **1** inch

Per MDE's Accounting Guidance, Accounting of Stormwater Wasteload Allocations, and Impervious Acres Treated (2014)

Step 1(c): Compute WQv

Water quality required for I = **31%**

$$WQ_{v(I)} = 0.278 \text{ ac-ft} = 12128 \text{ cft}$$

Minimum water quality required 0.2 inches per acre of the drainage area,

$$WQ_{v(\text{Min})} = 0.169 \text{ ac-ft} = 7347.12 \text{ cft}$$

$$\text{Water quality treatment required} = 12127.735 \text{ cft} = 0.2784 \text{ ac-ft}$$

Step 1(d): Water Quality Discharge

a. Runoff Volume = $Q_a = P \cdot R_v = 0.3301383$ in

b. CN for W_Q storm = **90.26** (from page D.10.1
2000 MDE Stormwater Management Manual)

c. Initial Abstraction = $I_a = (200/\text{CN}) - 2 = 0.22$

d. $I_a/P = 0.22$

e. Unit Peak Discharge = $q_u = 663$ csm/in (Figure D.11.1)

f. Water Quality Peak Flow = $Q_w = (q_u \text{ csm/in}) \cdot (A \text{ mi}^2) \cdot (q_a \text{ in}) = 3.46$ cfs

Step 2: Pretreatment Volume

Step 2(a) Stilling Basin Dimensions

from Carroll County Supplement to the Maryland
Stormwater Design Manual Volumes I & II

STILLING BASIN DIMENSIONS					
LEGEND					
PIPE DIA. (IN.)	"A" (FT.)	"B" (FT.)	"C" (FT.)	"D" (FT.)	"E" (FT.)
15"	5.64	2.50	7.50	6.28	0.63
18"	6.75	3.00	9.00	7.50	0.75
21"	7.89	3.50	10.50	8.78	0.88
24"	9.00	4.00	12.00	10.00	1.00
27"	10.14	4.50	13.50	11.28	1.13
30"	11.25	5.00	15.00	12.50	1.25
36"	13.50	6.00	18.00	15.00	1.50
42"	15.00	7.00	19.50	16.00	1.50
48"	16.50	8.00	21.00	17.00	1.50
54"	18.00	9.00	22.50	18.00	1.50
60"	19.50	10.00	24.00	19.00	1.50
72"	22.50	12.00	27.00	21.00	1.50
84"	25.50	14.00	30.00	23.00	1.50
96"	28.50	16.00	33.00	25.00	1.50
108"	31.50	18.00	36.00	27.00	1.50
120"	34.50	20.00	39.00	29.00	1.50

NOTES: DEPTH OF STILLING BASIN IS $\frac{1}{2}$ PIPE
DIAMETER UP TO THICKNESS OF FILTER
LAYER. THIS TABLE IS BASED ON A 18"
LAYER.

Stilling Basin #1:

Inflow #1 - 30" CMP

Step 3: Treatment

Step 3(a) Compute Storage Volume prior to Filtration: (100% of WQ_v)

$$V_{\text{temp}} = 12127.74 \text{ cft}$$

Step 3(b) Compute the Required Filter Bed Area: (A_f)

$$A_f = \frac{(WQ_v)(d_f)}{[k \times (h_f + d_f) \times t_f]}$$

Minimum Filter Bed Depth = 12"

$$\begin{aligned} \text{Design Filter Bed Depth (d}_f\text{)} &= 40 \text{ "} \\ &= 3.33 \text{ ft} \end{aligned}$$

Filter Media: SHA Bioretention Soil Mix
Coefficient of Permeability (k) = 2 ft/day

Filter Bed Drain Time (t_f) = 1.67 days

Design Temporary Ponding Height above the Filter Bed (t_p) = 2 ft

Design Average Height of Water above the Filter Bed (h_f) = 1 ft

$$A_f = 2793.12 \text{ sft}$$

Step 3(c) Design the Filter Chamber

Setting Width = 138 ft 1

Required Length = 20.2 ft

Design Length = 198 ft

Use a Filter Chamber 138 ft by 198 ft

Stage - Storage Data for Sand Filter								
Stage	Elevation	Area	Average Area	Incr. Storage	Total Storage		Storage Above Dead Storage	
(ft)	(ft)	(sft)	(sft)	(cft)	(cft)	(ac-ft)	(ac-ft)	(cft)
0.00	553.33	19733.40			0.0	0.0000	0.0000	0.00
			20563.77	20563.8				
1.00	554.33	21394.14			20563.8	0.4721	0.4721	20563.69
			22252.97	22253.0				
2.00	555.33	23111.80			42816.7	0.9829	0.9829	42816.57

$$V_{\text{treatment}} = (t_p \times l \times b) + (d_f \times l \times b \times 0.4)$$

$$= 79248.57 \text{ cft}$$

Step 4: Check

$V_{\text{total}} = 79248.57 \text{ cft}$

Required $V_{\text{total}} = 12127.74 \text{ cft}$

Design Criteria Satisfaction: Yes

Step 5: Compute Recharge Volume (Rev)

Step 5(a) : Determine Soil Specific Recharge Factor (S) Based on Hydrologic Soil Group

HSG	Soil Specific Recharge Factor (s)	
A	0.38	
B	0.26	
C	0.13	
D	0.07	
HSG	Drainage Area (ac)	Percentage (%)
A	0.00	0
B	10.12	100
C	0.00	0
D	0	0
Total	10.12	OK: sum of the areas matches site area

$$Re \ v = \frac{(S)(Rv)(A)}{12}$$

Composite S: 0.2600 Use 26.00 of site imperviousness

Step 5(b): Compute Rev Using Percent Volume Method

Rev = $[(S)(Rv)(A)]/12 = 0.072 \text{ ac-ft} = 3153 \text{ cft}$

Step 5(c): Compute Rev Using Percent Area Method

Rev = $(S)(A_i) = 0.819 \text{ ac} = 35675 \text{ sf}$

Recharge volume is included in the water quality volume.

The Rev requirement may be met by a) treating 0.072 ac-ft using structural method, b) treating 0.819 acres using non-structural methods, or c) a combination of both or it is part of WQv volume if not treated separately.

Storm Water Management Retrofit Evaluation						
Report Date:	3/22/2019	Design Approval:	4/16/1999	Maintenance Owner:	The Legends H.O.A. - c/o: Dale Ausherman	
Structure No (NPDES Number):	628	As-Built Date:	10/18/2001	Inspection Date:	6/5/2018	
Structure Name:	The Legends	NPDES Watershed:	Catoctin Creek	Inspection Team:	MV, VH	
Location:	Hogan Drive and Holter Road	MDE 8 Digit Name/#:	Catoctin Creek (2140305)	Last Significant Rainfall:	6/3/2018 (0.18")	
Northing/Easting:	639866.29/1164491.27	Land-River Segment:	B24021PM1_4000_4290	Rainfall Source:	www.wunderground.com	
		Stream Use:	1P	Station:	KMDJEFFE3	
BMP Description						
		Existing Condition		Proposed Condition		
General BMP Information						
BMP Type:	Bioretention / Extended Detention Dry Pond		Surface Sand Filter			
BMP Classification:	N/A		Stormwater Treatment (ST) Practice			
Management Type:	Quantity/Quality		Quality			
Total Drainage Area (acres):	72.3		54.46			
Total Impervious Area within Drainage Area (acres):	Unknown		10.4			
WQv Required:	Unknown		43860.95 cu.ft.	1.01 ac.ft.		
Does Facility Meet MDE 2000 WQv Requirements (Y/N):	No		Yes			
Adequate ROW (Y/N):	Yes		Yes			
Adequate Access (Y/N):	No		Yes			
Estimated Treatment Provided		Per Design	Per MDE 2000 Standards			
WQv Provided:	Unknown	0	115847.29 cu.ft.	2.66 ac.ft.		
Total Treated Drainage Area (acres):	72.3	0	54.46			
Minimum Impervious Area Treatment Provided (ac):	Unknown	0	10.4			
Estimated Pollutant Removal Rates						
Minimum Runoff Volume Treated per Impervious Acre (in.)	N/A		1.00			
34.95%						
54.92%						
69.90%						
Total Nitrogen:						
Total Phosphorus:						
Sediment:						
Estimated Pollutant Load Reduction				Edge of Stream (EOS)	Edge of Tide (EOT)	
TN (lbs/yr):	0		153.25		117.55	
TP (lbs/yr):	0		32.02		21.00	
TSS (lbs/yr):	0		27190.32		14788.04	
Projected Retrofit Cost:					\$779,688.00	

SITE ID: BMP #628

Prioritization Ranking: 12

Planning/Construction Level Cost Estimate: \$779,688.00

Estimated Cost/Impervious Acre: \$74,970.00

General BMP Information		
Structure Location:	Hogan Drive and Holter Road	
NPDES Number:	628	
Northing/Easting:	639866.29/1164491.27	
NPDES Watershed:	Catoctin Creek	
MDE 8 Digit Watershed:	Catoctin Creek (2140305)	
Proposed BMP Retrofit General Information		
Proposed BMP Type:	Surface Sand Filter	
Management Type:	Quality	
Total Drainage Area (ac):	54.46	
Total Impervious Area (ac):	10.40	
Water Quality Treatment Provided:		
WQv Provided (cu.ft.):	115847.29	
Total Treated Drainage Area (ac):	54.46	
Minimum Impervious Area Treatment Provided (ac):	10.40	
Estimated Nutrient Reductions:	EOS	EOT
TN (lbs/yr):	153.25	117.55
TP (lbs/yr):	32.02	21.00
TSS (lbs/yr):	27190.32	14788.04



BMP #628

Required Permitting

Frederick County SWM Review	X
Erosion and Sediment Control (ESC):	X
Grading Permit:	X
Joint Permit Application (JPA)/General Waterway Construction Permit:	
Construction NOI:	X
Other:	

EXISTING SITE CONDITIONS

BMP #628 is an existing extended detention dry pond / bioretention (Photo 1) with a 40' concrete weir (Photo 2). The concrete weir has a 4" PVC dewatering device and a 4" x 4" low flow orifice (Photo 3). The facility outfalls to the southwest via a riprap ditch (Photo 4). There are two (2) inflows to this facility. Inflow #1 is a riprap ditch entering the facility in the northeast corner. Inflow #2 is a 35" x 48" CMP with a concrete headwall entering the facility in the northwest corner. There is severe erosion in Inflow #1 (Photo 5). There are overhead utilities present at the site and an underground gas line that runs parallel to Holter Road. The surrounding land use is low-density residential.

PROPOSED RETROFIT

The proposed facility type for BMP #628 is an enhanced surface sand filter designed per *Carroll County Supplement to the Maryland Stormwater Design Manual Volumes I & II* which will provide quality management for 54.46 acres including a minimum impervious area treatment of 10.40 acres. The proposed facility will be constructed within the existing facility footprint. A forebay is proposed to capture flows from Inflow #1, Inflow #2, Inflow #3 and Inflow #4 because it will capture at least 10 acres of impervious. Our retrofit also includes repairing the severe erosion in Inflow #1. Per our analysis of available design plans and GIS contours, the existing triple 36" ALCMPs convey flow underneath

Holter Road at an approximate elevation of 576'. The approximate depth required to outfall the underdrain for the proposed facility is 3.33' per *Carroll County Supplement to the Maryland Stormwater Design Manual Volumes I & II*. As such, the facility bottom would need to be at 579.33'. The existing facility bottom is at elevation 582'; therefore, the proposed facility can use the existing facility bottom elevation. This elevation of 582' and an assumed depth of 2' for quality storage was used to determine quality sizing in our computations. The proposed underdrain would outfall at an approximate elevation of 578.66'. The facility size, embankment height and control structure will need to be evaluated during final design to determine quantity storage. The site can be accessed via Hogan Drive.

ANTICIPATED SITE CONSTRAINTS

There are existing overhead power lines and an existing underground gas line that runs parallel to Holter Road.



Photo 1: Overall facility looking northeast



Photo 2: Concrete weir looking southwest



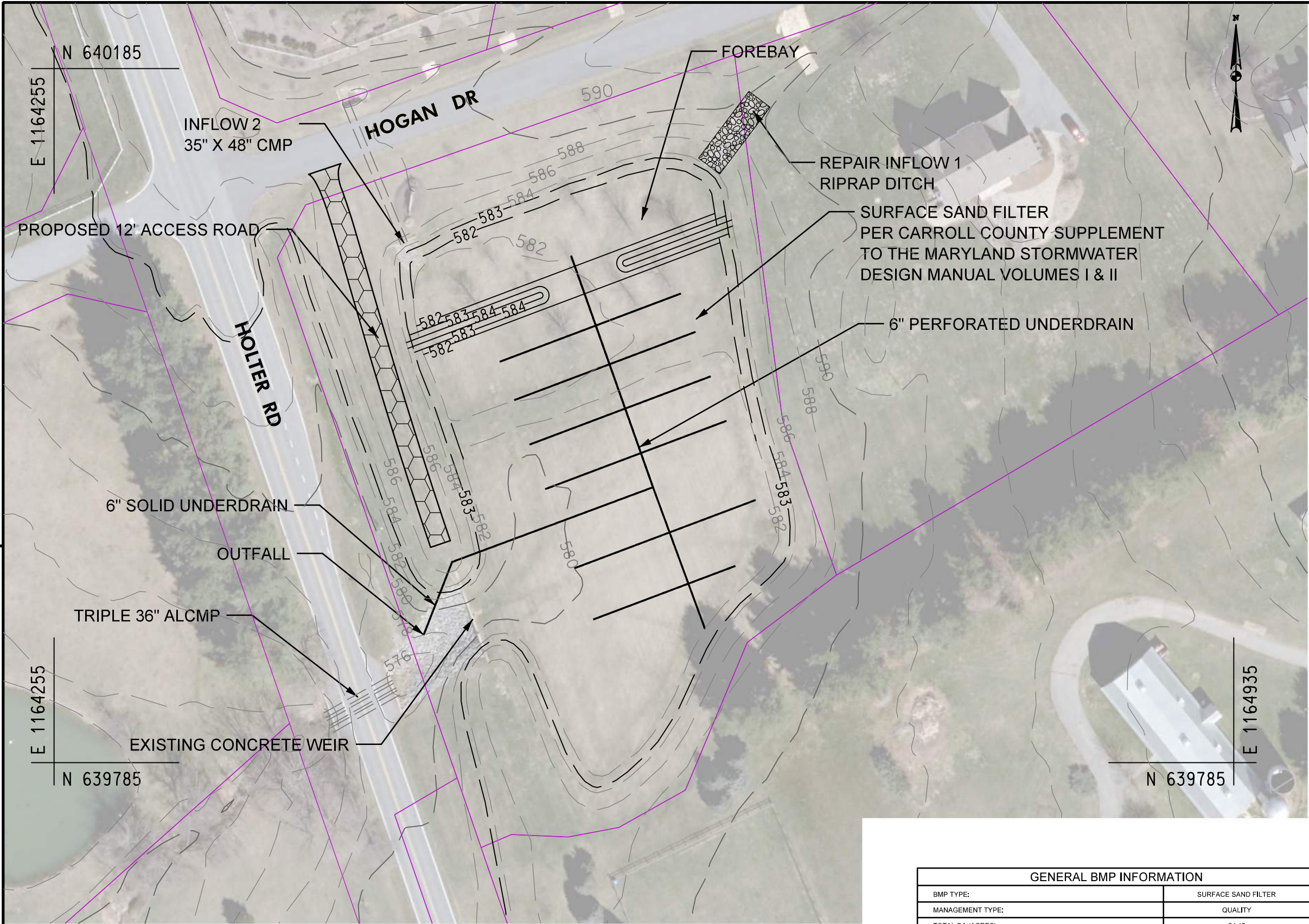
Photo 3: Downstream concrete weir looking northeast



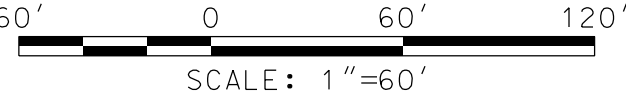
Photo 4: Downstream riprap channel looking southwest



Photo 5: Severe erosion in Inflow #1 looking northeast




- NOTE:
1. SURFACE SAND FILTER DESIGNED PER CARROLL COUNTY SUPPLEMENT TO THE MARYLAND STORMWATER DESIGN MANUAL VOLUMES I & II.
 2. FACILITY SIZE, EMBANKMENT HEIGHT AND CONTROL STRUCTURE SHOULD BE EVALUATED DURING FINAL DESIGN TO DETERMINE QUANTITY STORAGE.
 3. ONLY TWO-FOOT CONTOURS WERE AVAILABLE VIA GIS. ANY EXISTING ONE-FOOT CONTOURS WERE DIGITIZED BY OFFSETTING FROM THE TWO-FOOT CONTOURS.




GENERAL BMP INFORMATION	
BMP TYPE:	SURFACE SAND FILTER
MANAGEMENT TYPE:	QUALITY
TOTAL DA (ACRES):	54.46
TOTAL IMPERVIOUS AREA (ACRES):	10.40
WQv REQUIRED (CU. FT):	43860.95
WQv REQUIRED (AC. FT):	1.01
WATER QUALITY TREATMENT PROVIDED	
WQv PROVIDED (CU. FT):	115847.29
TOTAL TREATED DA (ACRES):	54.46
MINIMUM IMPERVIOUS AREA TREATMENT PROVIDED (ACRES):	10.40

LEGEND

- 400 — PARCEL BOUNDARY
- 400 — EXISTING GIS CONTOURS
- 400 — EXISTING DIGITIZED CONTOURS
- 400 — PROPOSED CONTOURS



Dewberry®
Dewberry Engineers
10461 MILL RUN CIRCLE
SUITE #300
OWINGS MILLS, MARYLAND 21117
PHONE: 410.265.9500
FAX: 410.265.8875



Catoctin Creek Watershed Assessment
Frederick County Office of Sustainability
and Environmental Resources
Frederick, MD 21701

BMP #628

SCALE: 1"=60' ADVERTISED DATE: CONTRACT NO.:

DESIGNED BY: VH COUNTY: Frederick, MD
DRAWN BY: VH LOGMILE:
CHECKED BY: MJ HORIZONTAL SCALE:
VERTICAL SCALE:

DRAWING NO. OF SHEET NO. OF

Project: **BMP 628** Surface Sand Filter
 Preliminary Design: per Carroll County Supplement to the Maryland Stormwater Design Manual Volumes I & II

Location: **Frederick County, Maryland**

Watershed: **Catoctin Creek** Stream Use:

Site Area: **54.46** ac **0.0850938** sqm

Measured Impervious Area: **10.4** ac
 $I = \frac{0.191}{19.10} =$ %

Soil Type: **B, C, D**

RCN Post Development : **74** $tc =$ **0.35** hr Per Frederick County's NPDES Database

Step 1: WQ_v Value

$$WQ_v = \frac{(P)(R_v)(A)}{12}$$

Step 1(a): Compute volumetric Runoff Coefficient(R_v)

$$R_v = 0.05 + (0.009)I =$$
 0.222

Step 1(b): Rainfall Zone

Rainfall Zone: Western Rainfall zone with Rainfall (P)= **1** inch

Per MDE's Accounting Guidance, Accounting of Stormwater Wasteload Allocations, and Impervious Acres Treated (2014)

Step 1(c): Compute WQ_v

Water quality required for I = **19%**

$$WQ_{v(I)} =$$
 1.007 ac-ft = **43861** cft

Minimum water quality required 0.2 inches per acre of the drainage area,

$$WQ_{v(\text{Min})} =$$
 0.908 ac-ft = **39537.96** cft

$$\text{Water quality treatment required} =$$
 43860.948 cft = **1.0069** ac-ft

Step 1(d): Water Quality Discharge

a. Runoff Volume = $Q_a = P \cdot R_v =$ **0.2218693** in

b. CN for W_Q storm = **86.93** (from page D.10.1
2000 MDE Stormwater Management Manual)

c. Initial Abstraction = $I_a = (200/CN) - 2 =$ **0.30**

d. $I_a/P =$ **0.30**

e. Unit Peak Discharge = $q_u =$ **530** csm/in (Figure D.11.1)

f. Water Quality Peak Flow = $Q_w = (q_u \text{ csm/in}) \cdot (A \text{ mi}^2) \cdot (q_a \text{ in}) =$ **10.01** cfs

Step 2: Pretreatment Volume

$$\left(A_s = \frac{Q_o}{W} \times E' \right)$$

Step 2(a) Compute Pretreatment Volume: (25% of WQ_v)

$$\text{Minimum Required } V_p =$$
 10965.24 cft

Step 2(b) Compute Sedimentation Basin Minimum Surface Area: (A_{sf})

$$A_{sf} =$$
 (0.066)(WQ_v), if $I \leq 75\%$
 $=$ **2894.82** sft

Step 2(c) Design the Sedimentation Basin

Design Width (w) = 40 ft
 Design Length (l) = 182 ft
 Suggested Length to Width Ratio = 2:1
 Required Depth = 1.5 ft
 Design Depth (d) = 2 ft
 Maximum Depth = 2'

1

Stage - Storage Data for Forebay						
Stage (ft)	Elevation (ft)	Area (sft)	Avg Area (sft)	Incr. (cft)	Storage (cft)	(ac-ft)
0.00	582.00	6739.13			0.0	0
1.00	583.00	8887.09	7813.11	7813.1	7813.1	0.17936
			9222.85	9222.8		
2.00	584.00	9558.61			17036.0	0.39109

Use a Sedimentation Chamber 40 ft by 182 ft by 2 ft = 17036.0 cft
 (with side slopes of 3:1)

Provided Vp = 17036.0 cft

Step 3: Treatment

Step 3(a) Compute Storage Volume prior to Filtration (including Pretreatment): (75% of WQ_v)

$V_{temp} = 32895.71$ cft

Step 3(b) Compute the Required Filter Bed Area: (A_f)

$$A_f = \frac{(WQ_v)(d_f)}{[k \times (h_f + d_f) \times t_f]}$$

Minimum Filter Bed Depth = 12"

Design Filter Bed Depth (d_p) = 40 "
 = 3.33 ft

Filter Media: SHA Bioretention Soil Mix
 Coefficient of Permeability (k) = 2 ft/day

Filter Bed Drain Time (t_d) = 1.67 days

Design Temporary Ponding Height above the Filter Bed (t_p) = 2 ft

Design Average Height of Water above the Filter Bed (h_p) = 1 ft

$A_f = 10101.55$ sft

Step 3(c) Design the Filter Chamber

Setting Width = 168 ft

Required Length = 60.1 ft

Design Length = 250 ft

Use a Filter Chamber 168 ft by 250 ft

Stage - Storage Data for Sand Filter								
Stage	Elevation	Area	Average Area	Incr. Storage	Total Storage		Storage Above Dead Storage	
(ft)	(ft)	(sft)	(sft)	(cft)	(cft)	(ac-ft)	(ac-ft)	(cft)
0.00	582.00	37283.79			0.0	0.0000	0.0000	0.00
			39352.32	39352.3				
1.00	583.00	41420.85			39352.3	0.9034	0.9034	39352.16
			42811.51	42811.5				
1.00	584.00	44202.17			42811.5	0.9828	0.9828	42811.34

$$V_{\text{treatment}} = (t_p \times l \times b) + (d_f \times l \times b \times 0.4)$$

$$= 98811.33619 \text{ cft}$$

Step 4: Check

$V_{\text{total}} = V_p + V_{\text{treatment}} = 115847.29 \text{ cft}$

Required Vtotal = 43860.95 cft

Design Criteria Satisfaction: Yes

Step 5: Compute Recharge Volume (Rev)

Step 5(a) : Determine Soil Specific Recharge Factor (S) Based on Hydrologic Soil Group

HSG	Soil Specific Recharge Factor (s)	
A	0.38	
B	0.26	
C	0.13	
D	0.07	
HSG	Drainage Area (ac)	Percentage (%)
A	0.00	0
B	48.46	89
C	4.46	8
D	1.54	3
Total	54.46	OK: sum of the areas

$$Rev = \frac{(S)(Rv)(A)}{12}$$

Composite S: 0.2440 Use 24.40 of site imperviousness

Step 5(b): Compute Rev Using Percent Volume Method

Rev = [(S)(Rv)(A)]/12 = 0.246 ac-ft = 10701 cft

Step 5(c): Compute Rev Using Percent Area Method

Rev = (S)(Ai) = 2.537 ac = 110528 sf

Recharge volume is included in the water quality volume.

The Rev requirement may be met by a) treating 0.246 ac-ft using structural method, b) treating 2.537 acres using non-structural methods, or c) a combination of both or it is part of WQv volume if not treated separately.

Storm Water Management Retrofit Evaluation					
Report Date:	3/22/2019	Design Approval:	6/10/2002	Maintenance Owner:	Maryland National Golf L.P.
Structure No (NPDES Number):	188	As-Built Date:	3/14/2007	Inspection Date:	5/24/2018
Structure Name:	The Hills @ Maryland National - Extended Detention Pond	NPDES Watershed:	Catoctin Creek	Inspection Team:	MV, JS
Location:	North of Maryland Court	MDE 8 Digit Name/#:	Catoctin Creek (2140305)	Last Significant Rainfall:	5/22/2018 (0.42")
Northing/Easting:	658426.43/1164356.17	Land-River Segment:	B24021PM1_3510_4000	Rainfall Source:	www.wunderground.com
		Stream Use:	IP	Station:	KMDJEFFE3
BMP Description					
	Existing Condition		Proposed Condition		
General BMP Information					
BMP Type:	Extended Detention Dry Pond		Surface Sand Filter		
BMP Classification:	N/A		Stormwater Treatment (ST) Practice		
Management Type:	Quantity/Quality		Quality		
Total Drainage Area (acres):	10.1		10.29		
Total Impervious Area within Drainage Area (acres):	Unknown		1.83		
WQv Required:	Unknown		7846.18 cu.ft.	0.18 ac.ft.	
Does Facility Meet MDE 2000 WQv Requirements (Y/N):	No		Yes		
Adequate ROW (Y/N):	Yes		Yes		
Adequate Access (Y/N):	No		Yes		
Estimated Treatment Provided		Per Design	Per MDE 2000 Standards		
WQv Provided:	Unknown	0	24948.87 cu.ft.	0.57 ac.ft.	
Total Treated Drainage Area (acres):	10.1	0	10.29		
Minimum Impervious Area Treatment Provided (ac):	Unknown	0	1.83		
Estimated Pollutant Removal Rates					
Minimum Runoff Volume Treated per Impervious Acre (in.)			1.00		
Total Nitrogen:	N/A		34.95%		
54.92%					
69.90%					
Total Phosphorus:					
Sediment:					
Estimated Pollutant Load Reduction			Edge of Stream (EOS)	Edge of Tide (EOT)	
TN (lbs/yr):	0		32.38	21.49	
TP (lbs/yr):	0		6.22	3.89	
TSS (lbs/yr):	0		9977.54	5602.20	
Projected Retrofit Cost:					\$137,195.10

SITE ID: BMP #188

Prioritization Ranking: 13

Planning/Construction Level Cost Estimate: \$137,195.10

Estimated Cost/Impervious Acre: \$74,970.00

<u>General BMP Information</u>		
Structure Location:	North of Maryland Court	
NPDES Number:	188	
Northing/Easting:	658426.43/1164356.17	
NPDES Watershed:	Catoctin Creek	
MDE 8 Digit Watershed:	Catoctin Creek (2140305)	
<u>Proposed BMP Retrofit General Information</u>		
Proposed BMP Type:	Surface Sand Filter	
Management Type:	Quality	
Total Drainage Area (ac):	10.29	
Total Impervious Area (ac):	1.83	
<u>Water Quality Treatment Provided:</u>		
WQv Provided (cu.ft.):	24948.87	
Total Treated Drainage Area (ac):	10.29	
Minimum Impervious Area Treatment Provided (ac):	1.83	
<u>Estimated Nutrient Reductions:</u>	<u>EOS</u>	<u>EOT</u>
TN (lbs/yr):	32.38	21.49
TP (lbs/yr):	6.22	3.89
TSS (lbs/yr):	9977.54	5602.20



BMP #188

Required Permitting

Frederick County SWM Review	X
Erosion and Sediment Control (ESC):	X
Grading Permit:	X
Joint Permit Application (JPA)/General Waterway Construction Permit:	
Construction NOI:	
Other: Chesapeake Bay TMDL Regional Permit	

EXISTING SITE CONDITIONS

BMP #188 is an existing extended detention dry pond (Photo 1) with an 18" ALCMP riser (Photo 2). The ALCMP riser has a 3" low flow orifice and a 15" ALCMP principal spillway that outfalls north of the facility (Photo 3) onto the Maryland National Golf Club property. There is one (1) inflow to this facility. Inflow #1 is a riprap ditch which conveys flow from the 35" x 24" CMP cross-culvert under Maryland Court and enters the facility in the southwest corner. There is a 20' emergency spillway located in the northeast corner of the facility. The facility has an existing 10' gravel access road that runs parallel to the riprap inflow ditch from Maryland Court. There are no overhead utilities present at the site or along the proposed access road. The surrounding land use is low-density residential and open urban land.

PROPOSED RETROFIT

The proposed facility type for BMP #188 is an enhanced surface sand filter designed per *Carroll County Supplement to the Maryland Stormwater Design Manual Volumes I & II* to be constructed within the existing facility footprint. The proposed facility will provide quality management for 10.29 acres including a minimum impervious area treatment of 1.83 acres. One stilling basin is proposed downstream of Inflow #1 (where the inflow channel meets the facility). Stilling

basin size is determined using the size of the inflow pipe. The existing facility bottom may need to be raised in order to outfall the facility through the existing principal spillway and should be evaluated during final design. Per our analysis of available design plans and GIS contours, the current principal spillway outfalls at an approximate elevation of 695'. The approximate depth required to outfall the underdrain for the proposed facility is 3.33' per *Carroll County Supplement to the Maryland Stormwater Design Manual Volumes I & II*. As such, the raised facility bottom would need to be at 598.33'. This elevation and an assumed depth of 2' for quality storage was used to determine quality sizing in our computations. The facility size and embankment height will need to be evaluated during final design to determine quantity storage. Removal of the existing riser should be evaluated during final design. The site can be accessed via Maryland Court and the proposed access road should be placed where the existing access road is shown on the original design plans.

ANTICIPATED SITE CONSTRAINTS

Additional easement acquisition may be necessary at this site.



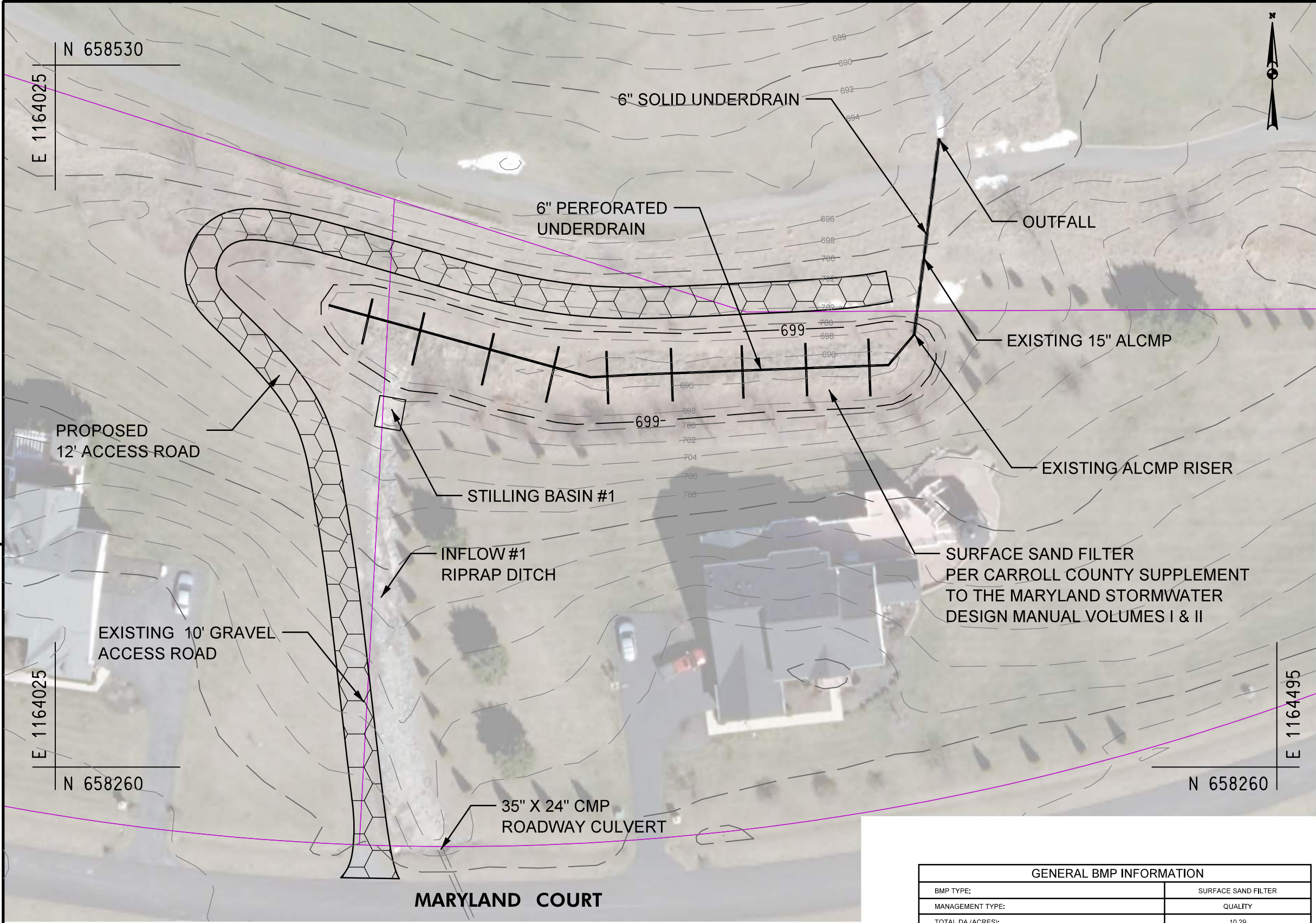
Photo 1: Overall facility looking east



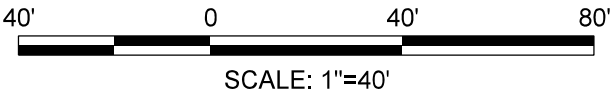
Photo 2: 18" ALCMP riser looking northeast




Photo 3: Downstream channel looking south



- NOTE:
- 1. SURFACE SAND FILTER DESIGNED PER CARROLL COUNTY SUPPLEMENT TO THE MARYLAND STORMWATER DESIGN MANUAL VOLUMES I & II.
 - 2. THE EXISTING FACILITY BOTTOM MAY NEED TO BE RAISED IN ORDER TO OUTFALL THE FACILITY AND SHOULD BE EVALUATED DURING FINAL DESIGN.
 - 3. FACILITY SIZE AND EMBANKMENT HEIGHT SHOULD BE EVALUATED DURING FINAL DESIGN TO DETERMINE QUANTITY STORAGE.
 - 4. REMOVAL OF THE EXISTING RISER SHOULD BE EVALUATED DURING FINAL DESIGN.
 - 5. PLACE PROPOSED ACCESS ROAD WHERE THE EXISTING ACCESS ROAD IS SHOWN ON THE ORIGINAL DESIGN PLANS.
 - 6. ONLY TWO-FOOT CONTOURS WERE AVAILABLE VIA GIS. ANY EXISTING ONE-FOOT CONTOURS WERE DIGITIZED BY OFFSETTING FROM THE TWO-FOOT CONTOURS.



GENERAL BMP INFORMATION	
BMP TYPE:	SURFACE SAND FILTER
MANAGEMENT TYPE:	QUALITY
TOTAL DA (ACRES):	10.29
TOTAL IMPERVIOUS AREA (ACRES):	1.83
WQv REQUIRED (CU. FT.):	7846.18
WQv REQUIRED (AC. FT.):	0.18
WATER QUALITY TREATMENT PROVIDED	
WQv PROVIDED (CU. FT.):	24948.87
TOTAL TREATED DA (ACRES):	10.29
MINIMUM IMPERVIOUS AREA TREATMENT PROVIDED (ACRES):	1.83




Catoctin Creek Watershed Assessment
Frederick County Office of Sustainability
and Environmental Resources
Frederick, MD 21701

BMP #188

SCALE: 1" = 40' ADVERTISED DATE: CONTRACT NO.:

DESIGNED BY: VH COUNTY: Frederick, MD
DRAWN BY: VH LOGMILE:
CHECKED BY: MJ HORIZONTAL SCALE:
VERTICAL SCALE:

DRAWING NO. OF SHEET NO. OF



Dewberry®
Dewberry Engineers
10461 MILL RUN CIRCLE
SUITE #300
OWINGS MILLS, MARYLAND 21117
PHONE: 410.265.9500
FAX: 410.265.8875

LEGEND
— PARCEL BOUNDARY
—400— EXISTING GIS CONTOURS
—400— EXISTING DIGITIZED CONTOURS

BY: vhamsher -

Project: **BMP 188** Surface Sand Filter
per Carroll County Supplement to the Maryland
Stormwater Design Manual Volumes I & II

Preliminary Design:

Location: **Frederick County, Maryland**

Watershed: **Catoctin Creek**

Stream Use:

Site Area: **10.29** ac **0.0160781** sqm

Measured Impervious Area:

1.83 ac
I = 0.178
= 17.78 %

Soil Type: **B, C**

RCN Post Development : **73** **tc = 0.14** hr Per Frederick County's NPDES Database

Step 1: WQv Value

$$WQ_v = \frac{(P)(R_v)(A)}{12}$$

Step 1(a): Compute volumetric Runoff Coefficient(Rv)

$$R_v = 0.05 + (0.009)I = \mathbf{0.210}$$

Step 1(b): Rainfall Zone

Rainfall Zone: Western Rainfall zone with Rainfall (P)= **1** inch

Per MDE's Accounting Guidance, Accounting of Stormwater Wasteload Allocations, and Impervious Acres Treated (2014)

Step 1(c): Compute WQv

Water quality required for I = **18%**

$$WQ_{v(I)} = \mathbf{0.180} \text{ ac-ft} = \mathbf{7846} \text{ cft}$$

Minimum water quality required 0.2 inches per acre of the drainage area,

$$WQ_{v(\text{Min})} = \mathbf{0.172} \text{ ac-ft} = \mathbf{7470.54} \text{ cft}$$

$$\text{Water quality treatment required} = \mathbf{7846.1838} \text{ cft} = \mathbf{0.1801} \text{ ac-ft}$$

Step 1(d): Water Quality Discharge

a. Runoff Volume = $Q_a = P \cdot R_v = \mathbf{0.2100583}$ in

b. CN for W_Q storm = **86.49** (from page D.10.1
2000 MDE Stormwater Management Manual)

c. Initial Abstraction = $I_a = (200/\text{CN}) - 2 = \mathbf{0.31}$

d. $I_a/P = \mathbf{0.31}$

e. Unit Peak Discharge = $q_u = \mathbf{804}$ csm/in (Figure D.11.1)

f. Water Quality Peak Flow = $Q_w = (q_u \text{ csm/in}) \cdot (A \text{ mi}^2) \cdot (q_a \text{ in}) = \mathbf{2.71}$ cfs

Step 2: Pretreatment Volume

Step 2(a) Stilling Basin Dimensions

from Carroll County Supplement to the Maryland
Stormwater Design Manual Volumes I & II

STILLING BASIN DIMENSIONS					
LEGEND					
PIPE DIA. (IN.)	"A" (FT.)	"B" (FT.)	"C" (FT.)	"D" (FT.)	"E" (FT.)
15"	5.64	2.50	7.50	6.28	0.63
18"	6.75	3.00	9.00	7.50	0.75
21"	7.89	3.50	10.50	8.78	0.88
24"	9.00	4.00	12.00	10.00	1.00
27"	10.14	4.50	13.50	11.28	1.13
30"	11.25	5.00	15.00	12.50	1.25
36"	13.50	6.00	18.00	15.00	1.50
42"	15.00	7.00	19.50	16.00	1.50
48"	16.50	8.00	21.00	17.00	1.50
54"	18.00	9.00	22.50	18.00	1.50
60"	19.50	10.00	24.00	19.00	1.50
72"	22.50	12.00	27.00	21.00	1.50
84"	25.50	14.00	30.00	23.00	1.50
96"	28.50	16.00	33.00	25.00	1.50
108"	31.50	18.00	36.00	27.00	1.50
120"	34.50	20.00	39.00	29.00	1.50

NOTES: DEPTH OF STILLING BASIN IS $\frac{1}{2}$ PIPE
DIAMETER UP TO THICKNESS OF FILTER
LAYER. THIS TABLE IS BASED ON A 18"
LAYER.

Stilling Basin #1:

Inflow #1 - 35" x 24" CMP

Step 3: Treatment

Step 3(a) Compute Storage Volume prior to Filtration: (100% of WQ_v)

$$V_{\text{temp}} = 7846.18 \text{ cft}$$

Step 3(b) Compute the Required Filter Bed Area: (A_f)

$$A_f = \frac{(WQ_v)(d_f)}{[k \times (h_f + d_f) \times t_f]}$$

Minimum Filter Bed Depth = 12"

$$\begin{aligned} \text{Design Filter Bed Depth (d}_f\text{)} &= 40 \text{ "} \\ &= 3.33 \text{ ft} \end{aligned}$$

Filter Media: SHA Bioretention Soil Mix
Coefficient of Permeability (k) = 2 ft/day

Filter Bed Drain Time (t_f) = 1.67 days

Design Temporary Ponding Height above the Filter Bed (t_p) = 2 ft

Design Average Height of Water above the Filter Bed (h_f) = 1 ft

$$A_f = 1807.04 \text{ sft}$$

Step 3(c) Design the Filter Chamber

Setting Width = 30 ft 1

Required Length = 60.2 ft

Design Length = 234 ft

Use a Filter Chamber 30 ft by 234 ft

Stage - Storage Data for Sand Filter								
Stage	Elevation	Area	Average Area	Incr. Storage	Total Storage		Storage Above Dead Storage	
(ft)	(ft)	(sft)	(sft)	(cft)	(cft)	(ac-ft)	(ac-ft)	(cft)
0.00	698.33	6130.04			0.0	0.0000	0.0000	0.00
			6890.54	6890.5				
1.00	699.33	7651.03			6890.5	0.1582	0.1582	6890.51
			8698.40	8698.4				
2.00	700.33	9745.76			15588.9	0.3579	0.3579	15588.87

$$V_{\text{treatment}} = (t_p \times l \times b) + (d_f \times l \times b \times 0.4)$$

$$= 24948.87 \text{ cft}$$

Step 4: Check

$V_{\text{total}} =$ 24948.87 cft

Required $V_{\text{total}} =$ 7846.18 cft

Design Criteria Satisfaction: Yes

Step 5: Compute Recharge Volume (Rev)

Step 5(a) : Determine Soil Specific Recharge Factor (S) Based on Hydrologic Soil Group

HSG	Soil Specific Recharge Factor (s)	
A	0.38	
B	0.26	
C	0.13	
D	0.07	
HSG	Drainage Area (ac)	Percentage (%)
A	0.00	0
B	10.29	100
C	0.00	0
D	0	0
Total	10.29	OK: sum of the areas matches site area

$$Re \ v = \frac{(S)(Rv)(A)}{12}$$

Composite S: 0.2600 Use 26.00 of site imperviousness

Step 5(b): Compute Rev Using Percent Volume Method

Rev = [(S)(Rv)(A)]/12 = 0.047 ac-ft = 2040 cft

Step 5(c): Compute Rev Using Percent Area Method

Rev = (S)(Ai) = 0.476 ac = 20726 sf

Recharge volume is included in the water quality volume.

The Rev requirement may be met by a) treating 0.047 ac-ft using structural method, b) treating 0.476 acres using non-structural methods, or c) a combination of both or it is part of WQv volume if not treated separately.